Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

MARCH ★ 1952

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 113—Journal Section of The American Society of Heating and Ventilating Engineers

Duct cleaning job requires acrobatic ability .... page 105

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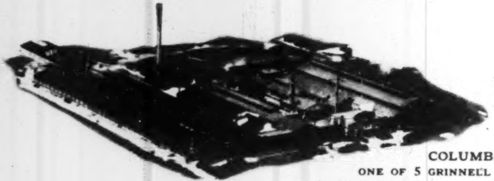
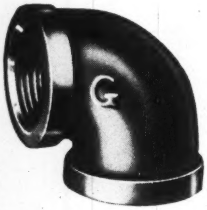


COLUMBIA, PA.
ONE OF 5 GRINNELL PLANTS
MANUFACTURING PIPE FITTINGS

GRINNELL complete-line manufacturer of high quality PIPE FITTINGS offers you...

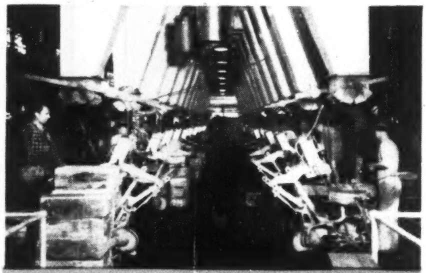


- Complete line of high quality malleable iron and cast iron pipe fittings.
- Large stocks of pipe fittings — mass-produced by skilled workers using modern equipment.
- Dependability — the result of finest materials, equipment and methods; assured by rigid production control and triple inspection.
- Coast-to-coast network of branch warehouses and distributors — making available local stocks of Grinnell pipe fittings.

WHENEVER YOU ORDER PIPE FITTINGS,
CALL YOUR NEARBY GRINNELL WAREHOUSE OR DISTRIBUTOR

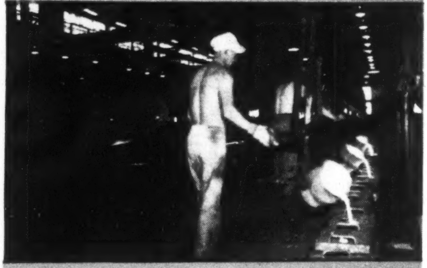
GRINNELL COMPANY

ONE OF 30 GRINNELL BRANCH WAREHOUSES



Dimensional accuracy assured by finest equipment and modern methods of mechanized molding.

Smooth inside finish obtained by the use of the best core sand and core making equipment.



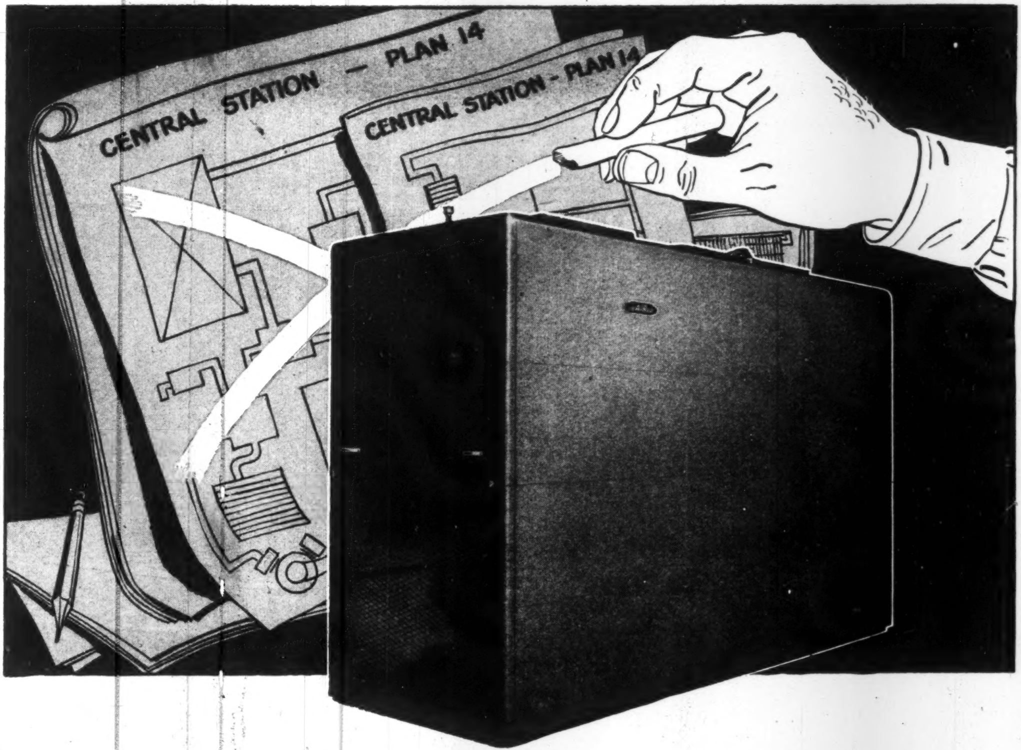
Superior metal, poured into molds on continuous conveyors, give Grinnell fittings extra strength.

Accurate chamfer and precision threads, produced by modern tapping machines, provide easy starting and tight joints.

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Why the Experts Are Specifying Refrigerated Kooler-aire Packaged Air Conditioning

More and more air conditioning experts are crossing off built up central station installations after looking at the advantages of USAIRco's package unit—Refrigerated Kooler-aire.

First, a packaged unit like Refrigerated Kooler-aire costs less to operate because it has *engineered balance* that's difficult to achieve on the job.

Second, Refrigerated Kooler-aire costs less to install because there are only 3 connections —to power, duct system and water and drain.

Third, it takes less space, since the components are built to work together.

Fourth, Refrigerated Kooler-aire uses less water, with the evaporative condenser designed to re-use 95 of every 100 gallons pumped through the system.

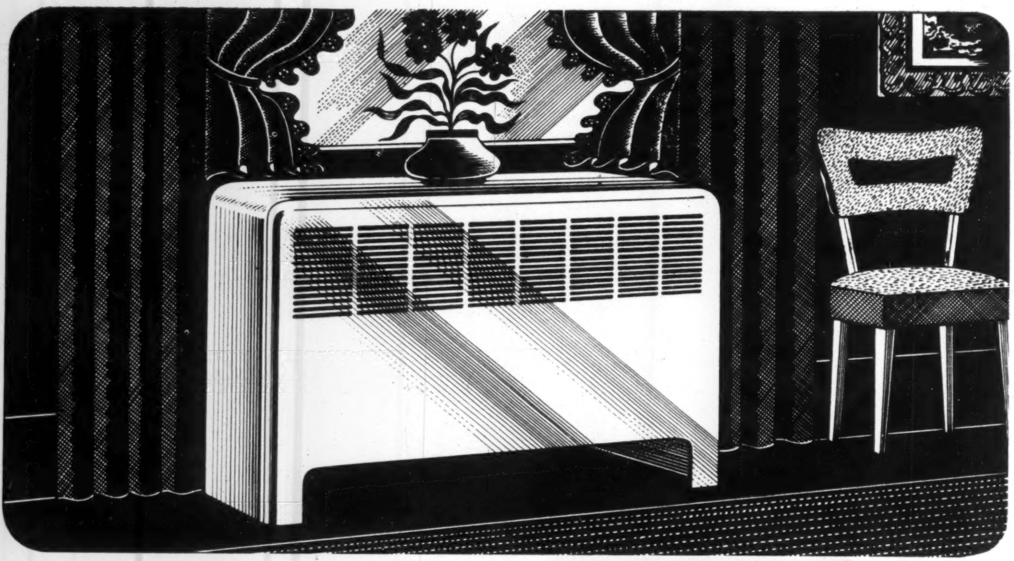
Of course there are other reasons, such as the complete range of sizes to fit every need—from 3 to 50 tons capacity. Get the whole story by mailing the coupon today. United States Air Conditioning Corporation, Minneapolis 14, Minnesota.

USAIRco

United States Air Conditioning Corporation
3300 Como Ave. S. E., Minneapolis 14, Minn.
Please send me the complete story on Refrigerated Kooler-aire.

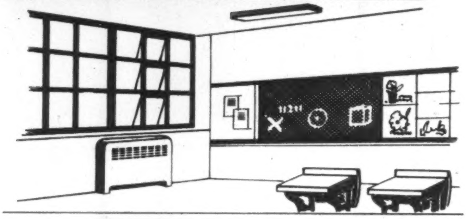
Name______________________________
Address____________________________
City____________________Zone_____State_____

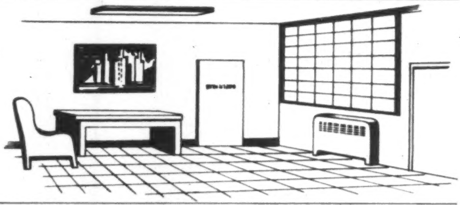
Designers and manufacturers of complete air conditioning equipment for 28 years.

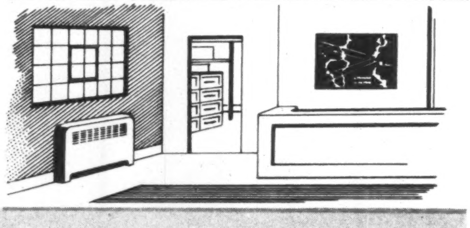


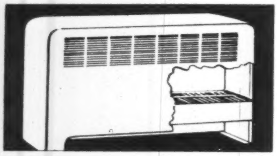
Streamlined Efficiency

Modern business is of necessity streamlined for utmost efficiency. Thus it is, to satisfy the demands of heating men everywhere, and to keep pace with this trend, that Bush offers their convector radiator. Universal two pipe non-ferrous elements (one pipe available in special element) and heavy gauge steel enclosures suitable for free standing or semi-recess, supply the modern touch to the heating installation. The completely removable front panel simplifies the installation and piping problems. Required pitch is easily obtained by a screw adjustment at either end of the element. Complete units are packed in individual cartons greatly reducing the storage and handling problems. A truly modern, functional unit that demands your attention and commands your respect. Write for Bulletin No. 545 for complete information.









Cutaway view showing element location and case construction.

BUSH MANUFACTURING COMPANY

WEST HARTFORD 10, CONNECTICUT

Since 1907

BUSH CONVECTORS *Ultra Smart*

Heating Piping & Air Conditioning

Vol. 24, No. 3

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION
AND MAINTENANCE IN
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PUBLISHER . . . . FRANK P. KEENEY
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Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, U.S. and possessions, 35c each; back copies, 60c each. January 1952 issue, $1.50 per copy. For change of address, notify publisher and your local postoffice of both old and new addresses by the 15th of the preceding month. Member Audit Bureau of Circulations and Associated Business Publications, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc. Copyright 1952 by the Keeney Publishing Co. Entered as Second Class Matter May 18, 1929, at the Post Office at Chicago, Ill., U.S.A., under the Act of March 3, 1879. Additional entry at Mendota, Ill.

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Now you can have

Performance Rated
air filters

FAR-AIR* originates greatly improved testing methods that take the guesswork out of air filtration!

All architects, engineers and reputable filter manufacturers know this important fact about air filters: *no filter—regardless of its design—operates at equal efficiency under all dust conditions.* For example, a filter may stop "gravel" with 100% efficiency, but may have 1% efficiency when exposed to dust particles of 0 to 5 micron size. (1 micron—1/25,000 inch.) The new FAR-AIR testing methods accurately rate filter efficiencies under *all* dust conditions – not just one set of laboratory conditions using a "standard" test dust, as in the past.

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This tremendous advancement in the science of air filtration is ready to serve you now. Your nearby Farr Field Engineer can be of valuable assistance in solving your air filtration problems. Why not call him today?

Technical Report
for Air Filters
FARR COMPANY

Write today for your copy of the free booklet on the new Farr testing procedures, which gives full technical information on the equipment used in these tests and the results obtained. Address: Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, California.

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*Trade Mark Reg.

FARR COMPANY *Manufacturing Engineers*

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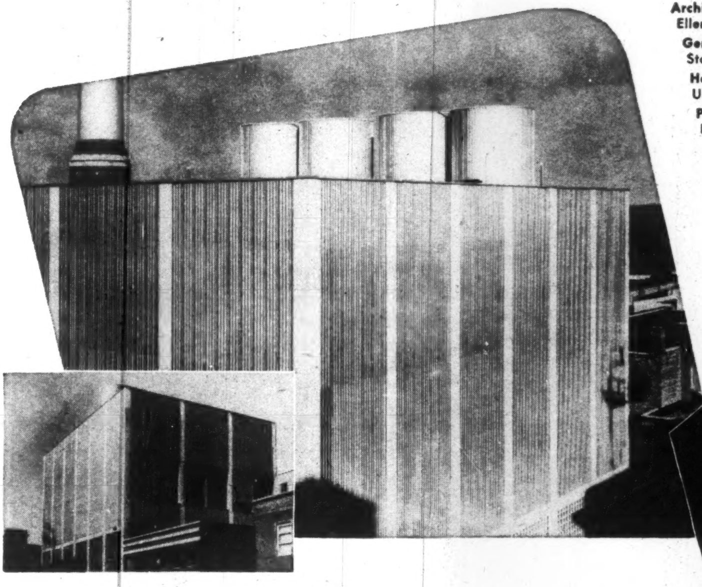
BIGGEST Comfort Air Conditioning Tower of 1951

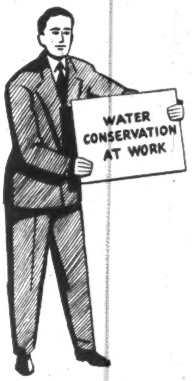
Architect and Engineer:
Ellerbe & Co., St. Paul, Minn.
General Contractor:
Stocke & Olsen, Rochester, Minn.
Heating and Ventilating Contractor:
Utility Sales & Engineering Co., Rochester, Minn.
Piping: Sanitary Plumbing & Heating Co., Rochester, Minn.

Cooling Tower:
Equipment Division,
J. F. Pritchard & Co., Kansas City, Mo.

Design Conditions:
Initial Capacity—12,000 gpm
Ultimate Capacity—24,000 gpm
15° F. Cooling Range
75° F. Wet Bulb Temperature



Built by Pritchard

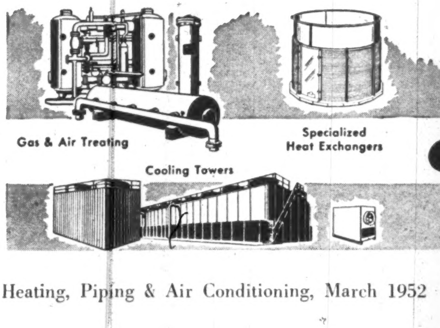


In 1951, Pritchard was given one of the most difficult assignments in comfort air conditioning history: Build a cooling tower for use on the Franklin Heating Station in Rochester, Minnesota. Because of the many complex design and engineering factors involved, it was necessary that this tower be extremely large . . . the *biggest* comfort air conditioning cooling tower anywhere in the world! The very nature of the installation made it absolutely necessary that the tower provide perfect, reliable service. Pritchard "know-how," combined with modern construction methods, proved equal to the task. The tower is now in use, ready to provide a *lifetime* of unfailing, efficient service.

Some of the major considerations thoroughly engineered for specific function were:

Sound Control ● Ice Formation ● Fog Dissipation
Condensate Control ● Drift Elimination
Thermal Capacity ● Mechanical Reliability
Architectural Appearance ● Operating Flexibility
Maintenance Facility ● Personnel Safety ● Insurability
Fire Hazards ● Material Compatibility
Structural Stability ● Building Code Conformance

This tower is additional *proof* of Pritchard's ability to design, fabricate and supervise the construction of cooling towers that meet the needs of any installation, no matter how complex. If *you* have a cooling tower problem, it will pay you to call Pritchard *first* and gain the benefit of Pritchard's experience. Your specific inquiry is invited.



Producers of QUALITY Specialized Process EQUIPMENT

J. F. Pritchard & Co.
EQUIPMENT DIVISION
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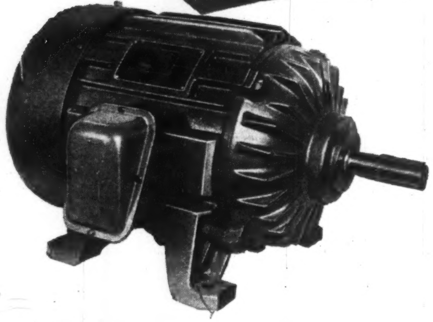
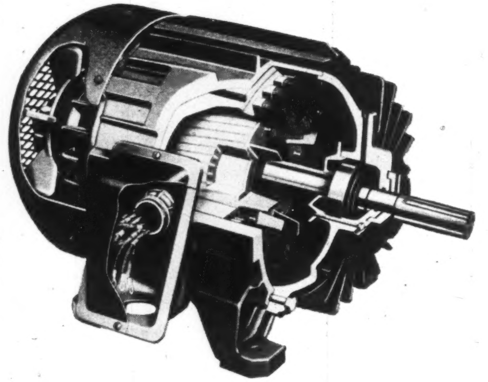
Totally-Enclosed Fan-Cooled



Look Outside

Greatly increased radiating area means greater cooling efficiency. More important, cooling efficiency stays high, regardless of operating conditions. There are no enclosed external air passages to clog and cause overheating. If oily dirt sticks, just wipe or blow it off. No matter how bad operating conditions are, this motor can be easily kept clean and cool running. Electrical parts are protected against corrosive atmospheres by cast iron yokes and end housings.



Look Inside

Double-shielded, heavy-duty ball bearings require no maintenance in ordinary service under most conditions. However, they can be lubricated without disassembly if required. Double shielding prevents over-lubrication, leading cause of bearing trouble. Rotating seals, where shaft extends through housings, keep dirt and moisture out of bearing chambers. Die cast rotor and interphase insulation are further assurance of long life and low maintenance.

See WHY THIS IS YOUR BEST MOTOR BUY

HERE IS A MOTOR that is different from conventional TEFC motors; built with an entirely different cooling system that gives you big savings in lower maintenance, more continuous service and less trouble in the toughest locations. Clogging can easily be prevented in the Allis-Chalmers Type APZ TEFC motor since areas that might collect dirt are exposed and easy to clean.

GET DETAILS NOW — *Ask your nearby Allis-Chalmers Authorized Distributor or District Office for more complete information on this high performance TEFC motor. Or write direct to Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.* A-3578

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

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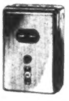
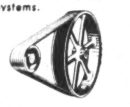
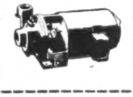


CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

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WORLD'S MOST WIDELY USED
SQUARE & RECTANGULAR
AIR DIFFUSERS

. . . and no wonder. AGITAIR Type R is the only diffuser to assure 100% air distribution in any shape area . . . from any location . . . without blank-offs or oversized outlets. Tailor-made for each application.

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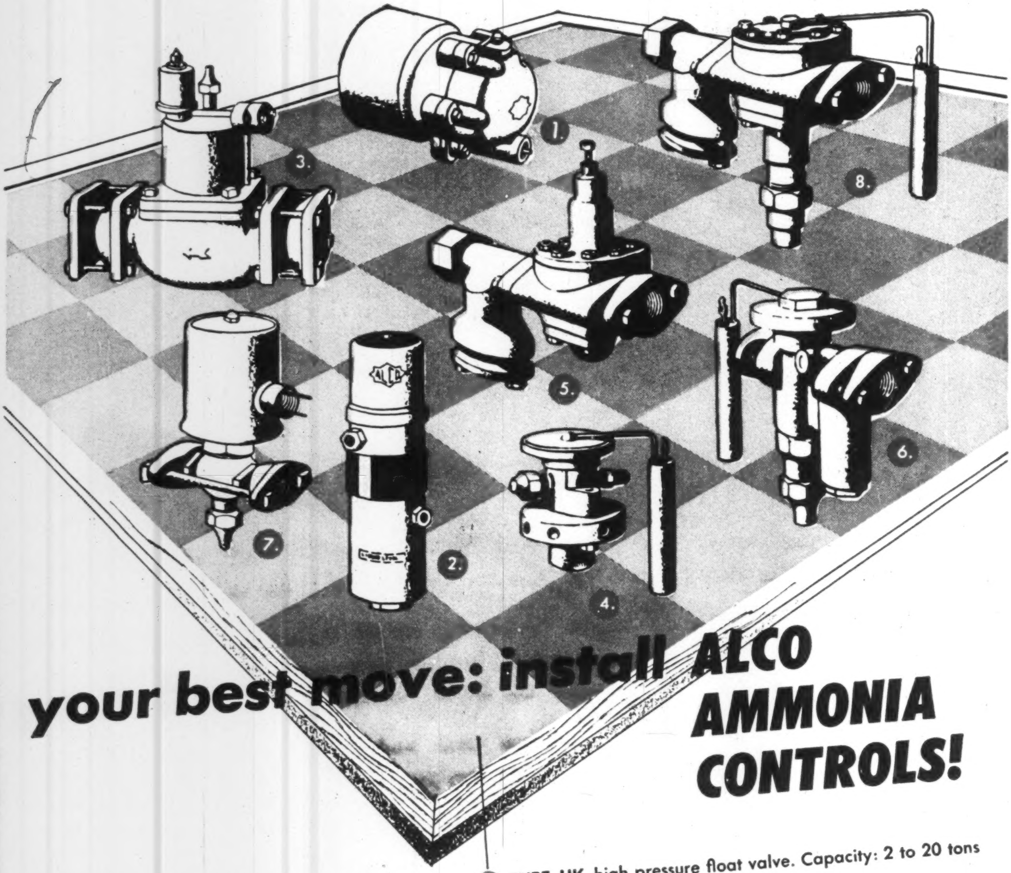
Air Diffusers • Air and Grease Filters • Exhausters



your best move: install ALCO AMMONIA CONTROLS!

With ALCO Ammonia Controls "across the board", you'll have a sure checkmate on excessive operating and maintenance costs. ALCO Controls are ruggedly built for dependable service and long, productive life. They keep your refrigeration system at peak efficiency, producing maximum ice at minimum cost.

Write for our Ammonia Bulletin #172 and **SEE YOUR ALCO WHOLESALER**

① **TYPE HK** high pressure float valve. Capacity: 2 to 20 tons Ammonia.

② **TYPE J5** electric float switch for control of solenoid valves, pumps, high-low level alarms. Up to 460 volts AC and 250 volts DC.

③ **TYPE EPR** for evaporator pressure control. Connection sizes ¾" to 6".

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⑤ **TYPE K & E** automatic expansion valve. Capacity: 1 to 64 tons Ammonia.

⑥ **TYPE UGZ** thermo expansion valve. Capacity: 1 to 20 tons Ammonia.

⑦ **TYPE M91F** solenoid valve. Capacity: 10 tons Ammonia.

⑧ **TYPE FR** thermo expansion valve. Capacity: 26 to 125 tons Ammonia.

ALCO VALVE CO.

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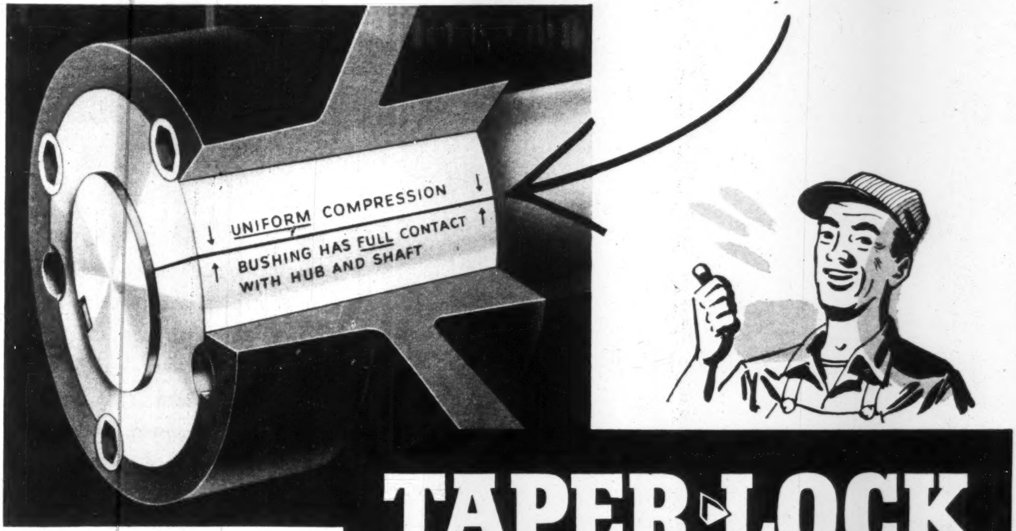
5016

Designers and Manufacturers of Thermostatic Expansion Valves; Pressure Regulating Valves; Solenoid Valves; Float Valves; Float Switches.

Here's the Big Difference!


UNIFORM COMPRESSION
BUSHING HAS FULL CONTACT WITH HUB AND SHAFT

TAPER-LOCK

–The Sheave that always runs true!

The Taper-Lock bushing seats evenly along the entire length of the hub. It is self-seating. There is no collar—no protruding part—no flange to prevent uniform compression.

With full contact, Taper-Lock sheaves run true. Made of finest grade of close-grained semi-steel, cast in the Dodge foundry. Precision grooves have identical pitch diameters so that every belt can pull its share of the load.

Sheave and bushing mount as a unit—easy to align on the shaft. Grips the shaft like a shrunk-on fit. Flush hub means safety.

THERE IS ONLY ONE TAPER-LOCK (a patented product of Dodge). Available from distributors' stocks in a complete range of sizes in A-B combination, B, C and D grooves. Also ask your distributors for Dodge Sealed-Life V-Belts. WRITE for complete data.

DODGE MANUFACTURING CORPORATION, 1600 Union St., Mishawaka, Indiana

DODGE

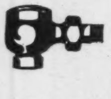
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

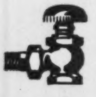
your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified phone book.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

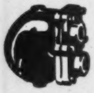
Sarco Dependability Assures Comfort Heating to HOSPITALS from Coast to Coast



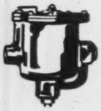
Sarco Type H
Radiator Trap



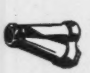
Sarco No. 1141
Radiator Valve



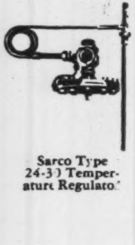
Sarco Type FT
Float-Thermostatic Trap



Sarco Type BMS
Inverted
Bucket Trap



Sarco Pipe
Line Strainer



Sarco Type
24-30 Temperature Regulator

Citizens General Hospital, New Kensington, Pa.

Sarco is taking a prominent part in the present active hospital construction and expansion program. Orders coming from every section of the country show that Sarco specialties enjoy national acceptance by hospital architects, engineers and contractors for heating, kitchen and hospital equipment, and temperature control for water heaters. Ask for catalog 200-3.

A few of the Hospitals for which Sarco specialties have been ordered during the last year.

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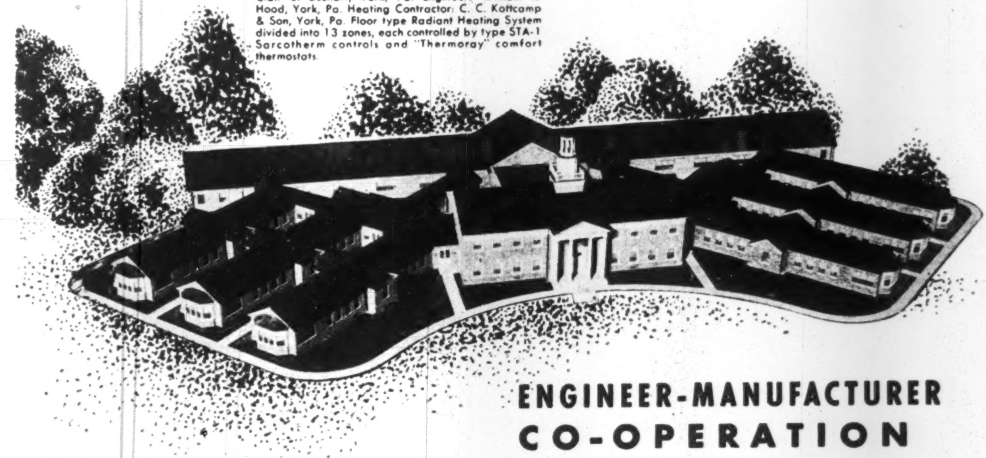
Ariz.	Phoenix	St. Joseph's Hospital
Colo.	Denver	Veterans Administration Hospital
Conn.	Derby	Griffin Hospital
Conn.	Norwich	Norwich State Hospital
Conn.	Willimantic	Windham Community Memor.
Fla.	Tampa	S. W. Fla. T.B. Sanatorium
Ga.	Monticello	Jasper County Hospital
Idaho	Boise	St. Adolphus Hospital
Ill.	Chicago	Michael Reese Hospital
Ill.	Evanston	Evanston Hosp.–Bldgs. A, B & C
Iowa	Audubon	Audubon County Hospital
Iowa	Cedar Rapids	St. Lukes Hospital
Ky.	Louisville	Veterans Administration Hospital
Mich.	Detroit	Receiving Hospital
Minn.	Fort Snelling	Veterans Administration Hospital
Minn.	Redwood Falls	New Hospital
Md.	Cheverly	Prince Georges County Hospital
Miss.	Hazelhurst	Copiah County Hospital
N. J.	Newton	Newton Memorial Hospital
N. J.	Secaucus	Hudson County Hospital
N. Y.	New York City	Beth El Hospital
N. Y.	New York City	E. Bronx T. B. Hospital
N. Y.	Beacon	Matteawan State Hospital
N. Y.	Buffalo	Roswell Park State Hospital
N. Y.	Ithaca	Herman M. Biggs Memorial
N. Y.	Utica	Utica State Hospital
N. Y.	Walton	Delaware Valley Hospital
Ohio	Ashtabula	Ashtabula General Hospital
Ohio	Dayton	St. Elizabeth's Hospital
Pa.	Danville	Danville State Hospital
Pa.	Embreeville	Embreeville State Hospital
Pa.	New Kensington	Citizens General Hospital
Tex.	Corpus Christi	Corpus Christi Memorial Hospital
Tex.	Denton	Flow Memorial Hospital
Va.	Suffolk	Louis Obici Memorial Hospital
Wash.	Seattle	Veterans Administration Hospital
Wis.	Madison	Madison General Hospital
Wyo.	Buffalo	Buffalo Hospital

356

SARCO COMPANY, INC.
EMPIRE STATE BUILDING • NEW YORK 1, N. Y.
Represented in Principal Cities
SARCO CANADA LTD., TORONTO 8, ONTARIO

ALWAYS SPECIFY SARCO

York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.



ENGINEER-MANUFACTURER CO-OPERATION

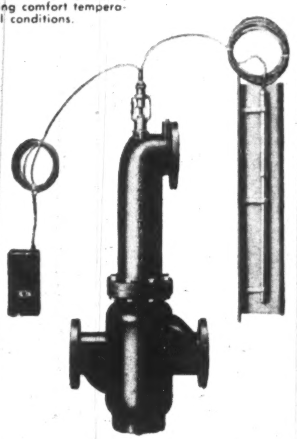
results in perfect comfort

WITH

Sarcotherm

RADIANT HEAT CONTROL

The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.



● Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

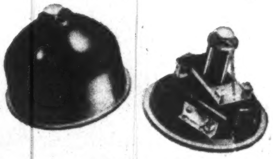
In the case of York County Home Annex illustrated, engineer William K. Hood, York, Pa., designed a radiant heating system divided into 13 zones, each individually controlled by Sarcotherm.

An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

Sarcotherm engineers are eager to work closely with architects, consulting engineers and contractors to develop the best control hook-up and assure its correct installation.

Send us your next problem—there is no obligation. Or write for complete catalogue.



● The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

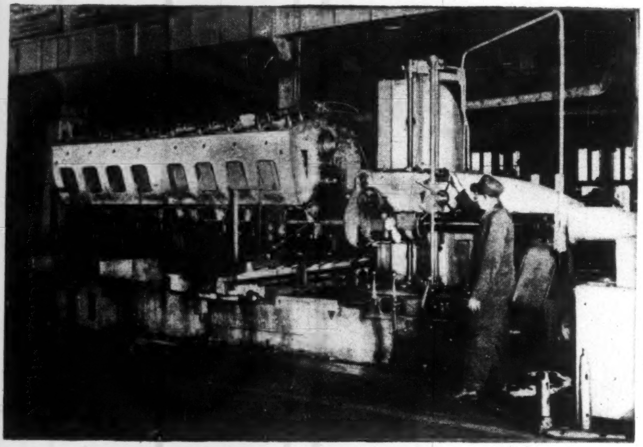
As part of the Sarcotherm control system it affords compensating indoor control without stopping circulation.

22

Sarcotherm CONTROLS, INC.
EMPIRE STATE BUILDING • NEW YORK 1, N. Y.

A SARCO PRODUCT

a Boring plus Performer*



FOR

Diesel

CRANKSHAFT BEARINGS

*And Now

BETTER PERFORMANCE

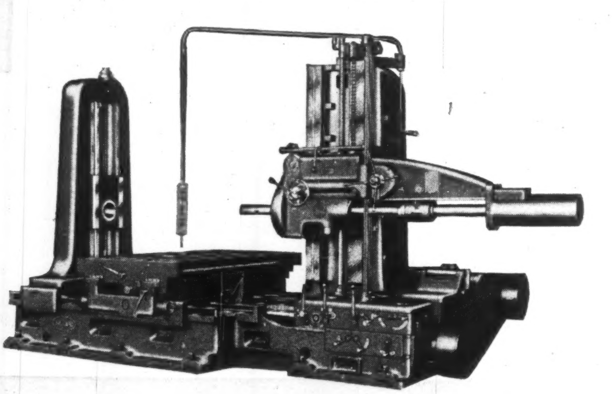
with

1. Broad Rigid 4-WAY bed
2. Heavier box type saddle and table.
3. Motor-driven lubricating pump for the gear boxes.
4. Improved hydrodynamic main drive.

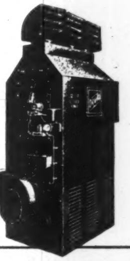
Here is a typical example of the adaptability of the Horizontal Boring Machine for a wide range of Diesel shop requirements. This 5″ machine, installed in a large mid-western shop in 1946, is shown boring a Diesel frame for crankshaft bearings using a 6″ dia. x 16′ bar and employing five tools at the same time. It has been used exclusively for this work for the past two years.

The new redesigned Bullard Horizontal Boring Machine is equipped to provide still higher standards of maintained accuracy and more versatile performance. The new heavier design, features a massive 4-WAY bed, motor-driven lubricating pump for the gear boxes, improved hydrodynamic main drive and other important improvements. Write for complete details or better still, have a Bullard man tell you what a Bullard Horizontal Boring, Milling and Drilling Machine can do for you in your own shop.

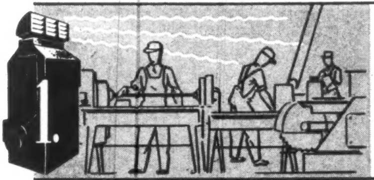
THE BULLARD COMPANY
Bridgeport 2, Conn.



HERE ARE
5 ways



A DRAVO
Counterflo **HEATER***
CAN WORK FOR YOU!
*DIRECT-FIRED

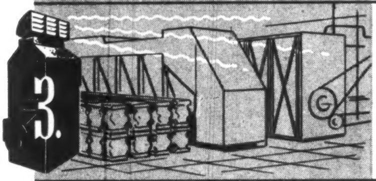


COMFORT HEATING *(commercial and industrial)*

Dravo Heaters have a 150-foot air throw and recirculate warm air at the working level, giving maximum comfort with minimum roof heat loss. No expensive pipe covering, radiators or ducts required. Quick warm-up; automatic on-off or modulating controls.

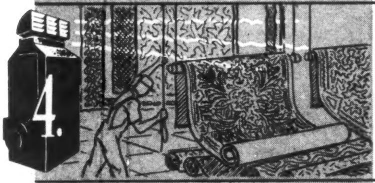
TEMPERING MAKE-UP AIR

Where dust-filled or fume-filled air must be removed from a building by exhausters, this air can be replaced and tempered by Dravo Heaters. Equal pressure is maintained . . . working conditions are kept comfortable.



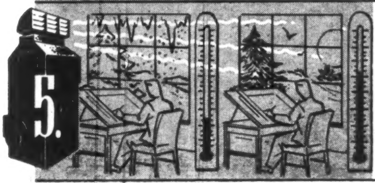
HEAT CURING

Dravo Heaters can be used independently or in combination with other equipment for process curing concrete, plastics, paper, fibre containers, rubber and many other products. Automatic temperature controls keep air flow at desired temperature.



PROCESS DRYING

Moisture content of air can be controlled or removed entirely by using fresh or recirculated air. Immediate response to temperature controller demand makes it ideal for drying paint, farm crops, wood products, rugs (after cleaning) and many other processes.



YEAR-'ROUND VENTILATION

In addition to comfort heating, Dravo Heaters provide fresh-air ventilation in warm weather and can be easily tied in with air-conditioning systems.

DRAVO HEATER *Plus* VALUES . . .

- **Low initial cost . . . users report 30% to 60% savings on installation.**
- **Direct-fired . . . low fuel consumption . . . burn gas or oil . . . readily converted.**
- **Long service life, low maintenance . . . stainless steel combustion chamber eliminates refractory lining.**
- **Easily moved to any location to fit your requirements.**
- **Flexibility . . . can be mounted horizontally or vertically on floor, walls or ceiling.**

WRITE FOR MORE INFORMATION. It's worth your while to look into Dravo *Counterflo* Heaters for any of these five functions shown above. You'll be glad you did. Ask for Bulletin No. ST-526-021.

DRAVO
CORPORATION

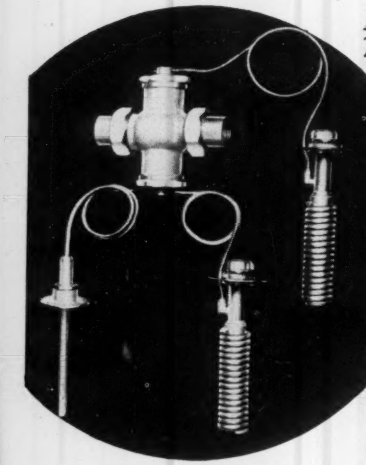
HEATING DEPARTMENT
Dravo Bldg., Fifth & Liberty Ave.
PITTSBURGH 22, PA.

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH
Sales Representatives in Principal Cities

DRAVO

Manufactured and sold in Canada by
Marine Industries, Ltd.,
Sorel, Quebec

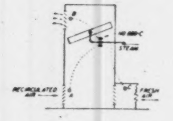
Export Associates:
Lynch, Wilde & Co.,
Washington 9, D. C.



Sylphon Regulator No. 889-C. Dual valve for temperature control of air and gases. Suitable for steam pressures up to 15 lbs. Other types available.

DEPENDABLE COMFORT wherever it goes!

Sylphon Control



Packaged Air Conditioner. Room temperature held constant by main port of No. 889-C from bulb "A" in recirculated air. Bulb "B" in discharge serves as "low limit" control to prevent cold drafts, with outdoor compensating bulb "C" to prevent "droop." For simplicity, the illustration above does not show condensing unit, filter, cooling coils or other details.

● In schools, offices, hotels, stores, institutions, theaters—wherever comfortable, constant temperature is required—thousands of Sylphon temperature regulators are on the job. For Sylphon controls are designed to meet any and every heating, ventilating or air conditioning requirement. One or a combination of these dependable regulators handles the job efficiently—inexpensively.

Sylphon Regulator 889-C, pictured here, is one of the Sylphon line. It is used for control of duct heating and ventilating systems. Fully modulating and self-powered, it has a simple dial adjustment—maintains temperature as wanted. No exposed operating mechanism—no wiring—no air piping required. Its packless valve eliminates service problems. Built for long, trouble-free service—like all Sylphon controls.

Write for details about Regulator 889-C, or for helpful information about other Sylphon Controls for your particular heating, ventilating or air conditioning requirements. Ask for Catalog EH-B.

FS

FIRST WITH BELLOWS

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON

DIVISION

ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

OIC
FOUNDED 1883

OIC
OIC
OIC STEEL
OIC
OIC
150
OIC FORGED STEEL 600
OIC

THE
LONG
LINE
OF VALVES

Ford Motor Company's new foundry at Cleveland employed many OIC Valves; forged and cast steel for the power plant, iron and bronze valves for the heating and process piping.

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO

OIC
FOUNDED 1883

VALVES
FORGED AND CAST STEEL · IRON · BRONZE

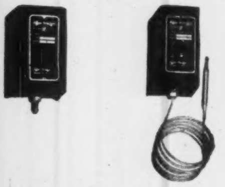
A-B
Quality
MILLS

A Mills Compressor equipped with an Allen-Bradley Bulletin 709 Automatic Starter installed in a manufacturing plant.

MILLS REFRIGERATION UNITS equipped with ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

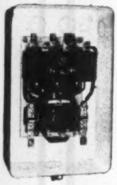
Typical Refrigeration Controls

PRESSURE AND TEMPERATURE CONTROLS



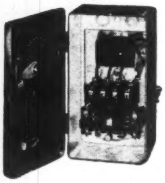
A-B Bulletin 836 pressure control and A-B Bulletin 837 temperature control. Accurate, rugged, compact units.

AUTOMATIC STARTER



A-B Bulletin 709 solenoid starter. Note white interior for ease of wiring.

COMBINATION STARTER



A-B Bulletin 712 disconnect switch type combination starter. Saves installation time.

Why are Allen-Bradley starters so popular for refrigeration and air conditioning service? . . . because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

American ENKA
NEBEL Nylons
BIBB The First Name in TEXTILES
Stonecutter FABRICS OF DISTINCTION
Celanese Fabric

Famous Labels suggest the choice

Many of the big textile mills . . . names your wife will recognize . . . "air-control" many of their manufacturing operations with Worthington air conditioning and refrigeration.

And many of the famous shops where the mills' products are sold . . . Saks Fifth Avenue, The Higbee Company, J. L. Brandeis, Lane Bryant, many Sears Roebuck Stores . . . are air-conditioned by Worthington.

No other manufacturer makes so complete a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

America's Leaders... in Many Businesses... Select

WORTHINGTON

A.2.9

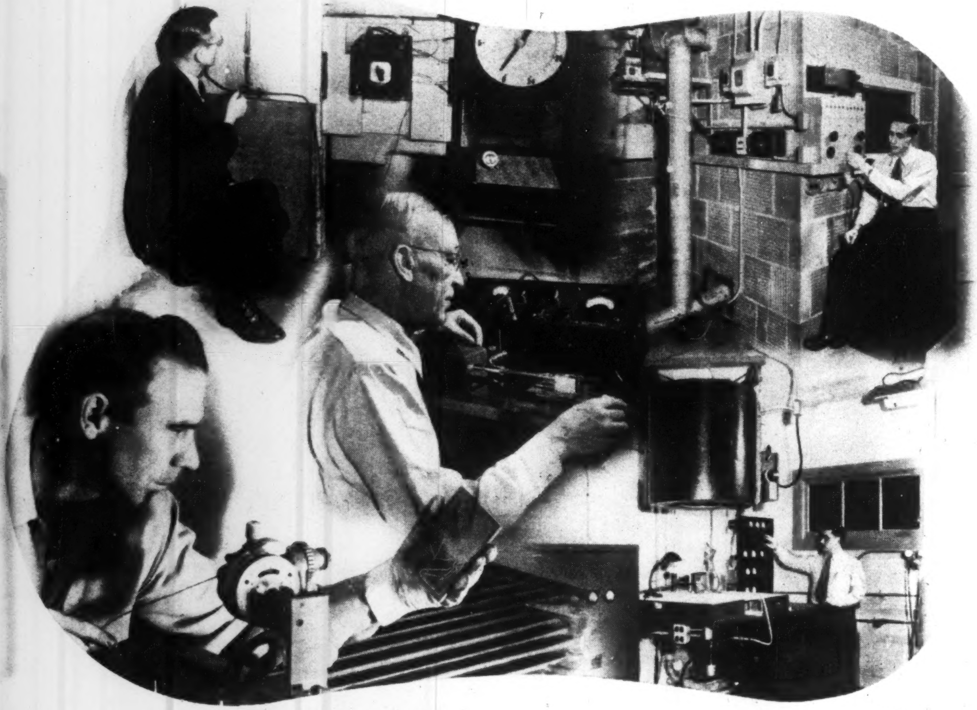
AIR CONDITIONING AND REFRIGERATION

The Most Complete Line... Always the Correct Recommendation

Conquest of the elements, the electron harnessed, attack on illness — aspects of these and other accomplishments of special interest to architects and engineers are found in

Your Progress Report from Honeywell

on the development of the science of temperature control

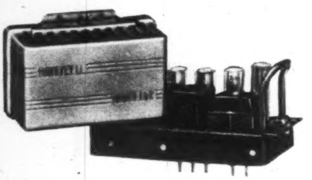


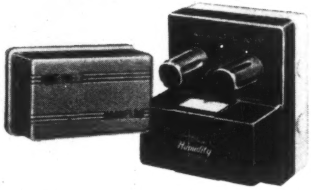
THERE'S a direct — and mighty important — relationship between the Honeywell products displayed on these two pages and the photo montage you see above.

Because one of the most important parts of Honeywell company policy from the beginning has been an insistence on thorough, painstaking research.

That's one big reason why Honeywell has been able to contribute so much to the development of the science of temperature control.

And that's why — when you specify Honeywell products like the eight shown here — you know you're giving your client the finest available anywhere





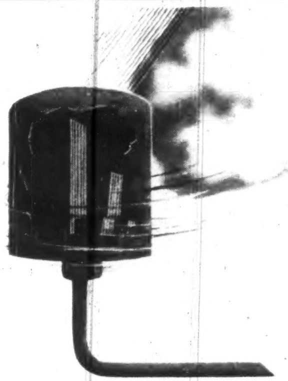
The sensitivity of electronics applied to

Air Conditioning Control

Here's a new system that enables you to give clients the ultimate in comfort — with increased efficiency and lower maintenance costs. Because it is *electronic*, it's *100 times as sensitive* as conventional systems — with faster reaction to changes in load, no temperature "overshoot," no waste of warm *or* cool air.

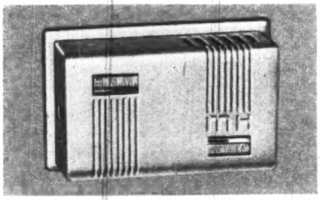
Humidity Control

A system that out-performs them all! That's what Honeywell's new Electronic Humidity Control System does — with an accuracy that a few years ago was considered unattainable. Ideal for use where conditions demand absolutely *uniform* humidity, it's a *thousand times* more sensitive than ordinary systems.



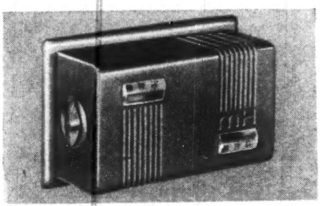
Weatherstat – compensates for wind, sun and exposure

Here's a product unique with Honeywell – the Weatherstat – only outdoor control system of its kind. It's remarkably accurate because it meters heat not only in relation to outside temperatures, but to *wind and sun conditions as well!* This amazing control is designed for use on all larger buildings. Mounted out-of-doors, it gives highly effective temperature control *indoors* because it functions as a miniature of the building or area of the building it controls. And it saves up to 20% on fuel.



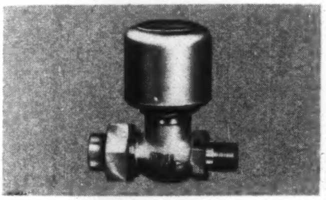
Shockproof equipment tested at sea

Honeywell controls like the Grad-U-Stat shown above have passed the toughest use-test of all – service at sea. Experience gained in making vibration-proof, corrosion-proof sea-going controls has enabled Honeywell engineers to design controls that give a better, more satisfying performance in buildings ashore.



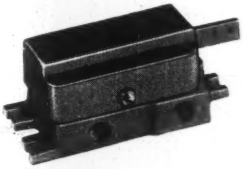
Only Thermostat specially designed for hospital use

Designed to give maximum hospital efficiency, the Honeywell hospital thermostat offers many exclusive features. Features like the *"Nite-Glowing" dials* which permit inspection without disturbing patients; *magnified numerals* for easier readings; a *Speed-Set control knob* that's camouflaged against tampering.



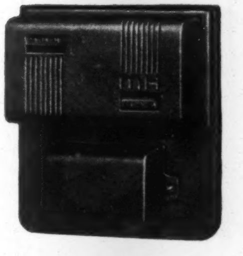
"Midget" Radiator Valve a great space saver

Only *one-fourth* the size of conventional valves, the Midget Radiator Valve delivers top performance. Its compactness makes it ideal for concealed convectors – and for all other applications where you're pressed for space. And because of its small size, it's easier to install and maintain.



Gradutrol Relay – first in its field

This Honeywell-developed control has made possible a marked increase in efficiency of pneumatic air conditioning and fan ventilating systems. When used to control damper motors its positive positioning feature cuts down "lag," eliminates "overshoot" – giving your clients better, more even, more economical cooling. And in valve applications the Gradutrol Relay guarantees the most economical sequencing.



Automatic Reset ~~Relay ends~~ "cycling"

When Honeywell engineers developed the Reset Relay (shown above, teamed with a Honeywell Grad-U-Stat), they opened the way to vastly improved pneumatic heating systems. For a pneumatic system incorporating this remarkable new control simply doesn't allow "seesawing" temperatures. The Reset Relay reduces offset by 90%, and allows wider throttling range settings, thus giving the system greater stability with no "hunting" or "cycling," and allows your clients to keep temperatures constant no matter how changeable the weather.

* * *

For additional information on how these Honeywell products and systems can help *you* better serve your clients, call your local Honeywell office. There are 91 – located across the nation. Or fill in and mail the coupon below today.

MINNEAPOLIS-HONEYWELL
Dept. HA-3-62,
Minneapolis 8, Minn.

Gentlemen: Please send me further information on:

- ☐ Weatherstat
- ☐ Midget Radiator Valve
- ☐ Shockproof Controls
- ☐ Gradutrol Relay
- ☐ Electronic Air Conditioning Control
- ☐ Electronic Humidity Control
- ☐ Hospital Thermostat
- ☐ Automatic Reset Relay

Name..........

Firm Name..........

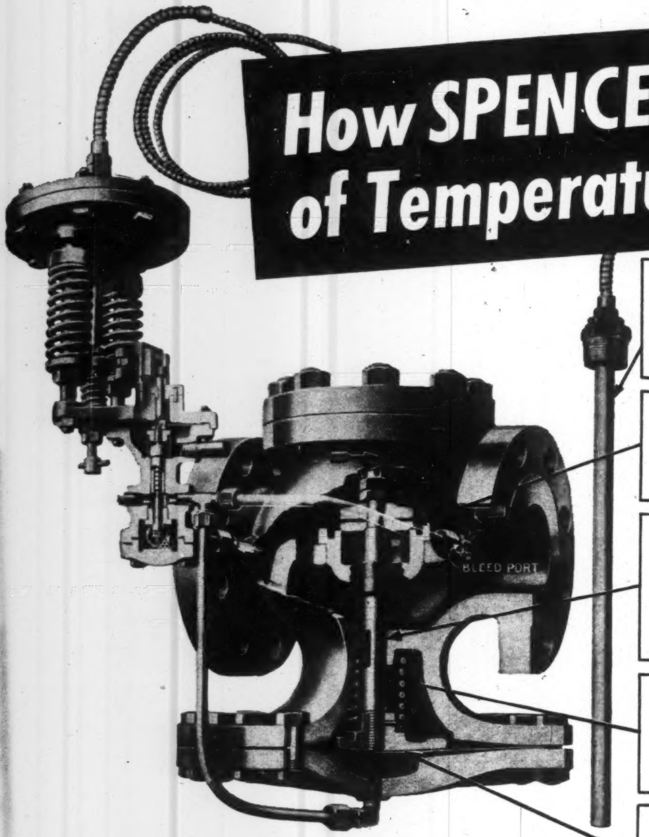
Address..........

City.......... *Zone*...... *State*..........

MINNEAPOLIS
Honeywell

First in Controls

How SPENCE Cuts Costs of Temperature Control



NEW THERMOSTAT ELEMENT—Improved to practically eliminate loss of filling. Rugged construction; cannot be injured by overheating.

SECO METAL—Seats and discs are made of SECO Metal—guaranteed not to wiredraw.

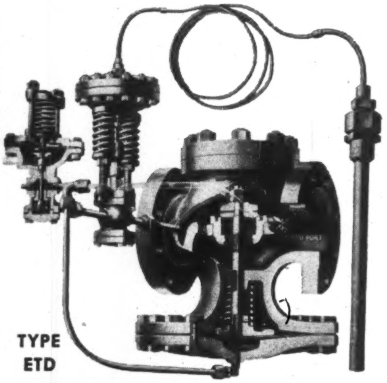
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

PROTECTED SPRINGS — Springs in the Spence Regulator are out of the path of the steam or other fluid flowing through the valve.

LARGE BALANCED DIAPHRAGM— Spence metal diaphragms, under usual conditions, never require replacement.

Accurate Control for Both Storage and Instantaneous Heaters

Spence Temperature Regulators reduce the steam pressure and also accurately modulate the flow as required to control the temperature. No separate reducing valve is necessary • The Spence ET150 Regulator is recommended for heater pressures up to 50 psi. For higher pressures the Type ETD is available • For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200.

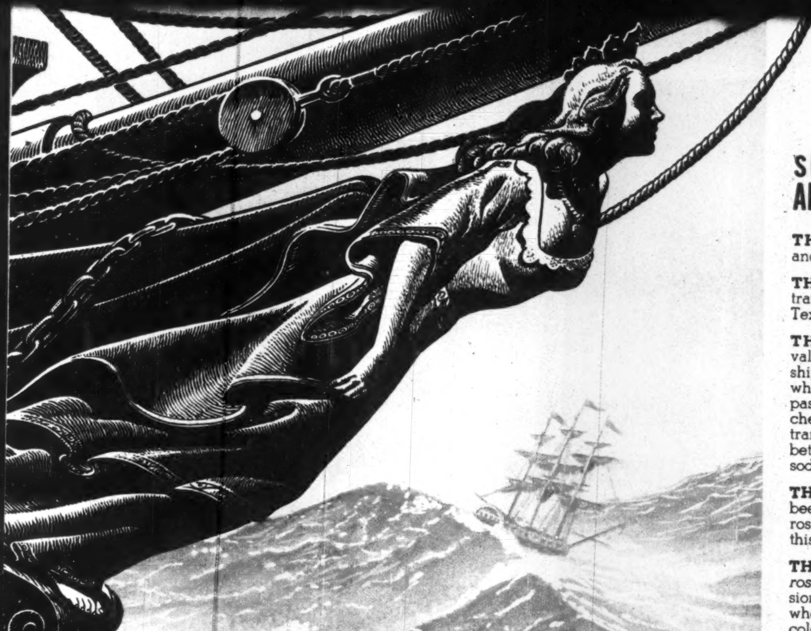


TYPE ETD

SE 111

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK



Lasts longer in corrosive service

This bolted bonnet type Y valve, made to special order in a wide range of alloys, is especially engineered for severe corrosive service. Like all ALOYCO valves, its dependable performance results from: metallurgical research devoted exclusively to corrosive applications . . . foundry and machine shop facilities set up for high alloy valves *only* . . . casting and machining practices dictated by the difficult characteristics of the alloys required for corrosive services.

ALOYCO No. 361 Y Valve for 150 pounds service furnished in a wide range of alloys.

SUCCESS STORIES FROM ALOYCO'S CORROSION CLINIC

THE CORROSIVE: 50% caustic soda and other industrial chemicals.

THE PLACE: S. S. "Marine Chemist", transporting bulk chemicals from Freeport, Texas, to northeastern ports of United States.

THE VALVE: ALOYCO 20 No. 111 gate valves. Valves in the ballast tanks of the ship are alternately submerged in sea water while caustic soda and other chemicals pass through the valves. In some instances, chemicals are in constant motion during transportation. Temperatures of 100°F and better must be maintained to keep caustic soda from solidifying.

THE RESULTS: ALOYCO valves have been successfully combating *interior* corrosion and *external* corrosion as well in this unusual application for two years.

THE BACKGROUND: The *Aloyco Corrosion Clinic* works exclusively in corrosion-resistant alloys. If your problem—whether it be corrosion, contamination, discoloration, temperature extremes, or proper application—can be solved by corrosion-resistant valves, it is one for the Clinic.

ALOYCO concentrates on providing longer valve life in corrosive service. Result: More ALOYCO corrosion-resistant valves are used than any other brand.

ALOYCO is the *largest* manufacturer specializing in high alloy valves. For a dependable solution, put your problem up to *Aloyco's Corrosion Clinic.*

Marine Transport Lines' floating chemical carrier —S. S. "Marine Chemist"—in service for the Dow Chemical Company—transports bulk industrial chemicals.

ALLOY STEEL PRODUCTS CO., INC.
1332 West Elizabeth Avenue, Linden, N. J.

Longer Lasting
ALOYCO VALVES
1st in Corrosive Service

PUTTING Air TO WORK FOR FIBERGLAS

Without an infallible air supply at many process stages, Owens-Corning could not make their famous Fiberglas.

FAN THE FIRE

TO MAKE A MILLION MARBLES

These machines swallow glass at 2200°F, spit out 320 red-hot marbles a minute. In one day, they produce more than a million marbles to feed forming machines turning out a multitude of famous Fiberglas products.

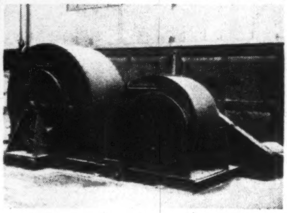
Air plays a vital role in many ways in glass making. Take, for example, the combustion air to the glass furnace. If it failed for only a short time, the entire melt would be lost and it would require a week to rebuild the furnace. And throughout this huge plant, over 150 Sturtevant fans like those pictured at right give production an assist by *putting air to work* in both cooling and heating processes.

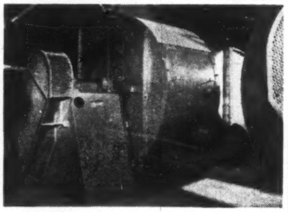
Our specialty is making air work for you . . . with a complete line of air handling, air conditioning and air cleaning apparatus. For help on your problem, call your local Westinghouse-Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

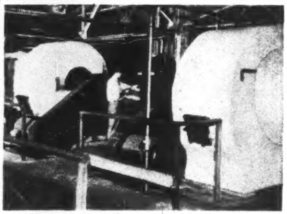
YOU CAN BE SURE... IF IT'S

Westinghouse

I-80242


Sturtevant fans keep furnace exteriors cool, prevent refractory brick from disintegrating.


Tiny fibers of glass are formed into Fiberglas mat by air, put to work with Sturtevant fans.


Heavy-duty fans drive air at high temperatures through Fiberglas mat to cure bonding agent.

They're DROP FORGED

# of STEEL...

W-S Screw-End and Socket-Weld Fittings

There are several big benefits to you implied in this simple statement of fact about W-S Fittings.

First, forging means *strength*—the strongest, most compact physical form, steel for steel, obtainable by commercial methods of fabrication.

Second, *being* stronger, forged fittings are much *smaller* and *lighter*, size for size, than other types.

Third, *dimensional accuracy* is characteristic of the forging process—and because forged bodies *are* more accurate, they chuck better, can be machined to *closer*, more *uniform tolerances* than other types.

To these inherent advantages of *forged* fittings, add Watson-Stillman's modern manufacturing facilities, a production control system that's air-tight from furnace to finished product, and a sales engineering staff dedicated to SERVICE in the largest sense of the word. The total is heavily weighted in favor of the advantages of W-S Double-Diamond Forged Steel Fittings.

• Lower Service Cost • More Uniform
• Stronger • Smaller • Lighter • Tighter

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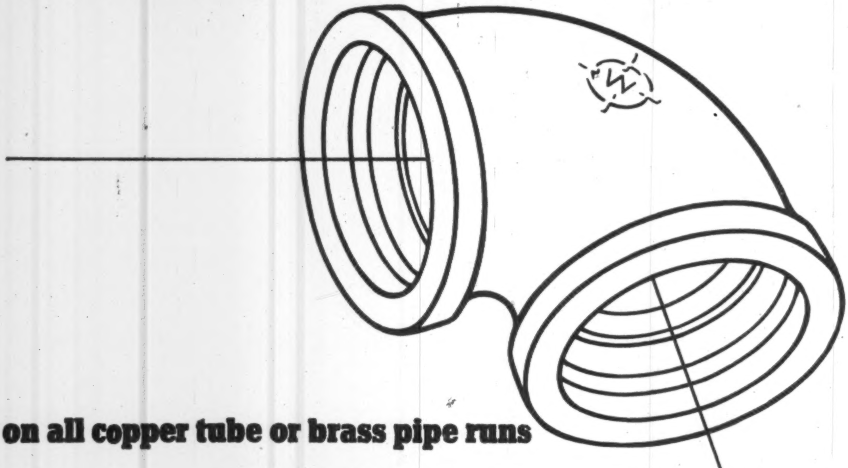
Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

The sure way to cut the cost of pipe maintenance



on all copper tube or brass pipe runs

...SPECIFY THREADLESS

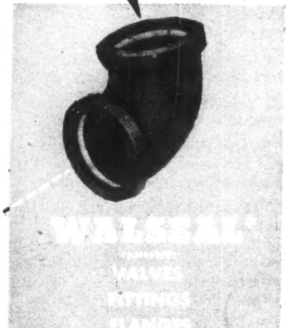
SILBRAZ* JOINTS

Whenever your plans call for copper tube (iron pipe size) or brass pipe — especially in public, industrial or commercial buildings — specify patented threadless Silbraz joints made with Walseal valves, fittings and flanges. Silbraz joints effectively produce strong, lasting pipe runs.

These modern joints provide positive protection against leaks by actually becoming a part of the pipe itself. They make a "one-piece" pipe line that will not creep or pull apart under any pressure, shock or vibration that the pipe itself can withstand.

Easily installed by oxyacetylene torch brazing, Silbraz joints are the sure answer to low-cost assemblies that will require neither maintenance nor repair in the years to come. Ask your nearest Walworth distributor, or write for copy of Circular 84 giving complete data on Walseal Silbraz joints.

*Patented – Reg. U.S. Patent Office



Make it a "one-piece pipe line" with WALSEAL

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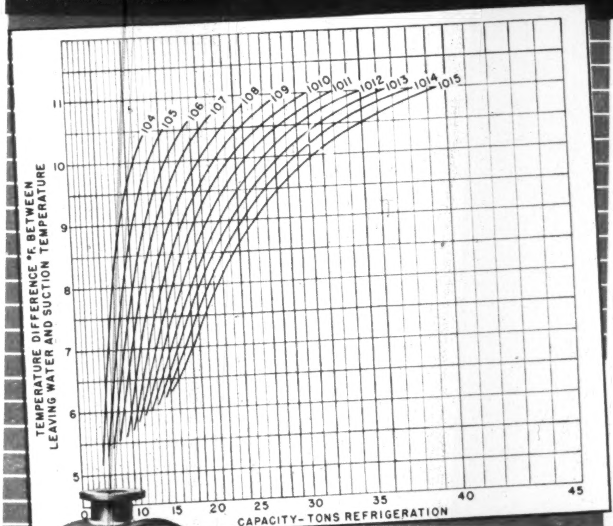
valves and fittings
60 EAST 42nd STREET, NEW YORK 17, N. Y.
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

HOW TO SELECT AN EVAPORATOR *the Easy Way*



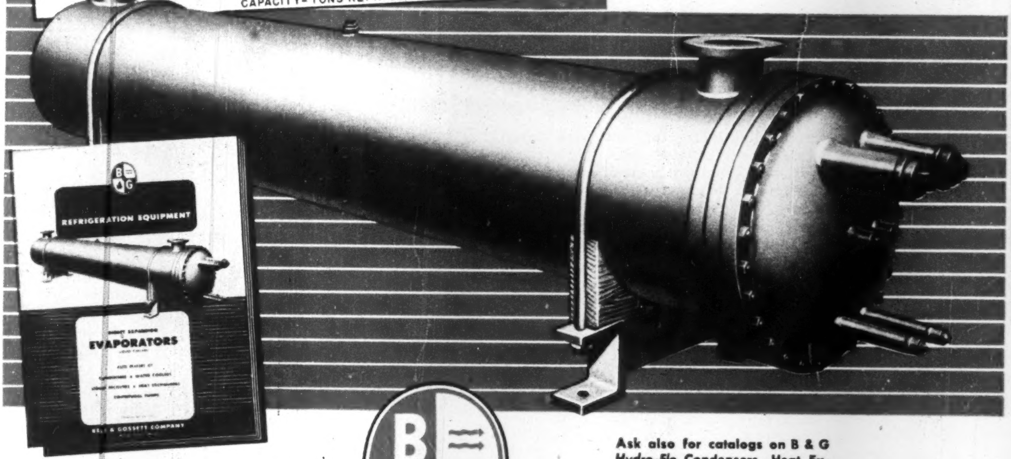
Send for new B & G Evaporator Catalog with simplified engineering and selection data

The chart shown here illustrates one of the ways in which B & G has made evaporator selection a simple matter. Most calculations are translated into chart form—shortening designing time.

The B & G Series "HR" Evaporator offers distinctive features which mean more efficient and dependable performance. The construction, for example, which prevents oil-trapping in the head passes and assures uninterrupted oil and vapor flow.

Easier to install and insulate

Removable steel legs are adjustable to meet various mounting conditions. A heavy hardwood block is furnished for insertion between the shell and support legs—making the unit easier to insulate and preventing damage from condensation. Shell connections extend well beyond the insulation cover—a great convenience when installing.



Ask also for catalogs on B & G *Hydro-Flo* Condensers, Heat Exchangers and Centrifugal Pumps.

B&G SERIES 1522 CENTRIFUGAL PUMP

Eight big design features—ideal for cooling tower and evaporative condenser installations.

*Hydro-Flo**

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BELL & GOSSETT COMPANY

Dept. RCK-5, Morton Grove, Ill.

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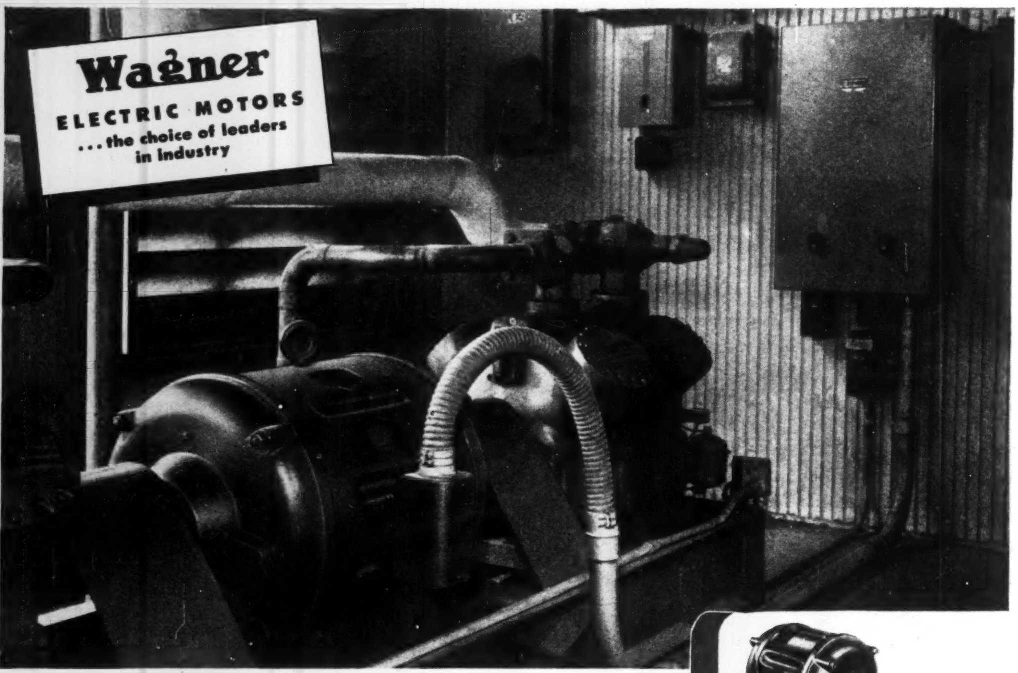


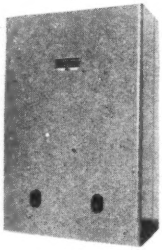
Investigate the many advantages of using

the Wagner Part-Winding Increment Motor and Starter Combination

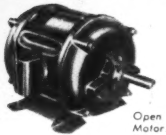
The Wagner part-winding increment motor and starter combination provides an economical method of starting polyphase squirrel-cage motors when reduced current draw at start is required. No auto-transformers or resistors are necessary.

Wagner polyphase motors for part-winding starting, both normal and high torque, are wound with two circuits in parallel. The magnetic type increment starter has two magnetic contactors. When the first contactor closes, the line is connected to one group of the motor windings and a pneumatic timer is started. After the desired time interval, the pneumatic timer closes the second magnetic contactor which connects the line to the other part of the motor winding. Using this motor and starter combination, the current drawn from the line is about 60 percent of the normal locked current of the motor. It has the advantage that the current taken from the line is not broken during the starting period, as is the case when auto-transformers or compensator-type starters are used.

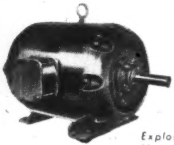
Motors with manual type starters are also available.



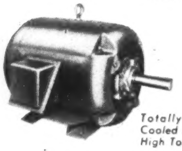
This magnetic part-winding increment starter can be furnished in combination with any of these Wagner Motors.



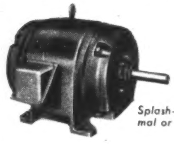
Open General Purpose Motor. Normal or High Torque.



Explosion-Proof Motor. Normal or High Torque.



Totally-Enclosed Fan-Cooled Motor. Normal or High Torque.



Splash-Proof Motor. Normal or High Torque.

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Electric Corporation
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WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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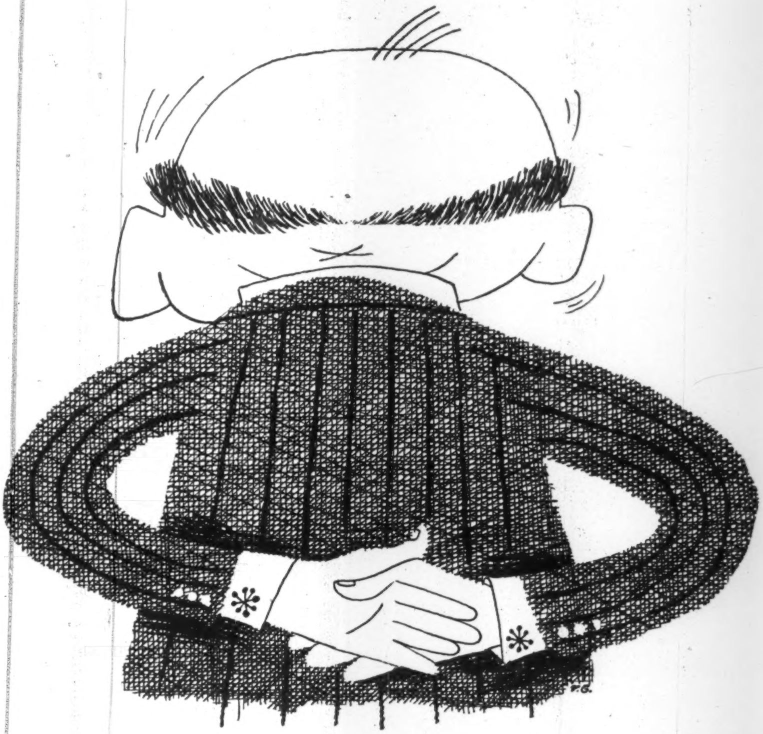

Would you turn your back on a 4-for-1 saving?

MORE THAN 10,000 DOREX USERS are glad they didn't. They're the economy-wise buyers who, over the past twenty years, have made Dorex Air Recovery part of their air conditioning installations.

You see, Dorex Air Recovery "manufactures" *fresh* air by passing *used* air through the famous Dorex C Cell, with beds of specially activated carbon that remove all odorous and gaseous impurities. This means *only about one-third* as much new air need be taken into the system. Substantially less heating and cooling equipment is needed; operating costs are much lower.

Specifically, users' experience has shown that every $100 invested in Dorex Air Recovery should return a saving of $400 on initial air conditioning expense; and, over the years, every $1 spent for Dorex maintenance should produce a $4 saving in operating costs.

Find out how much this four-for-one return can add up to in your plant. Write us for full information.

DOREX TRADE MARK "DOREX" REG. U.S. PAT. OFF.
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AIR **diffusion · purification · recovery**
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W. B. CONNOR ENGINEERING CORP.
Dept. B-32, Danbury, Connecticut
Please send me, without obligation, full information on Dorex Air Recovery.

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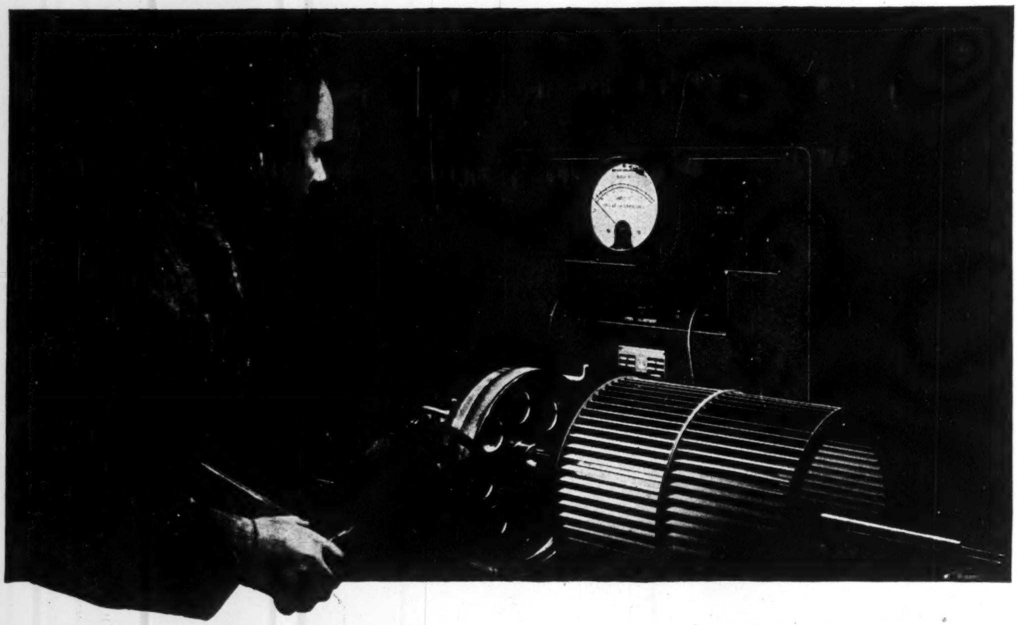
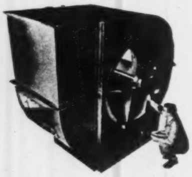


Hairline balance cuts vibration in TRANE fans

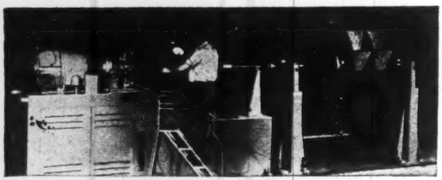


When TRANE engineers set out to balance TRANE Fans, they insisted on such exacting precision that two more major TRANE Fan advantages were created. Ultra-modern electronic machinery, for dynamically and statically balancing fans, was tailor-made to TRANE requirements. Balancing procedures were worked out so carefully that the tolerance permitted between wheel centerline and the center of gravity of the wheel is equal or less than the infinitely small space needed to slip the hub over the shaft. Thus TRANE Fan balance is as accurate as the fit of the hub to the shaft.

This hairline balance cuts vibration of TRANE Fans to an irreducible minimum. That's advantage Number One. As a result, fan bearings, the only point of friction in a fan, last much longer. And TRANE Fans, large as well as small, can be installed anywhere in the building without danger of damage due to vibration. Advantage Number Two is less noise. As vibration is eliminated, noise, too, is reduced.

Besides less vibration and lower noise levels, other TRANE Fan features include rugged construction for long life—streamlined air inlet that moves more air with less power—more accurate fit and tolerance for consistent performance—chlorinated rubber base paint finish to prevent corrosion.

TRANE Fans are available in Class 1 and 2 construction for many applications. They are particularly valuable when combined with TRANE Cooling and Heating Coils for a complete central air conditioning system. In TRANE Coils, the streamlined fin-and-tube and the smooth TRANE Fin offer minimum resistance to air flow. This low air friction and higher efficiency of TRANE Fans produce better performance with lower horsepower consumption. For more details concerning TRANE products, contact the TRANE sales office nearest you.

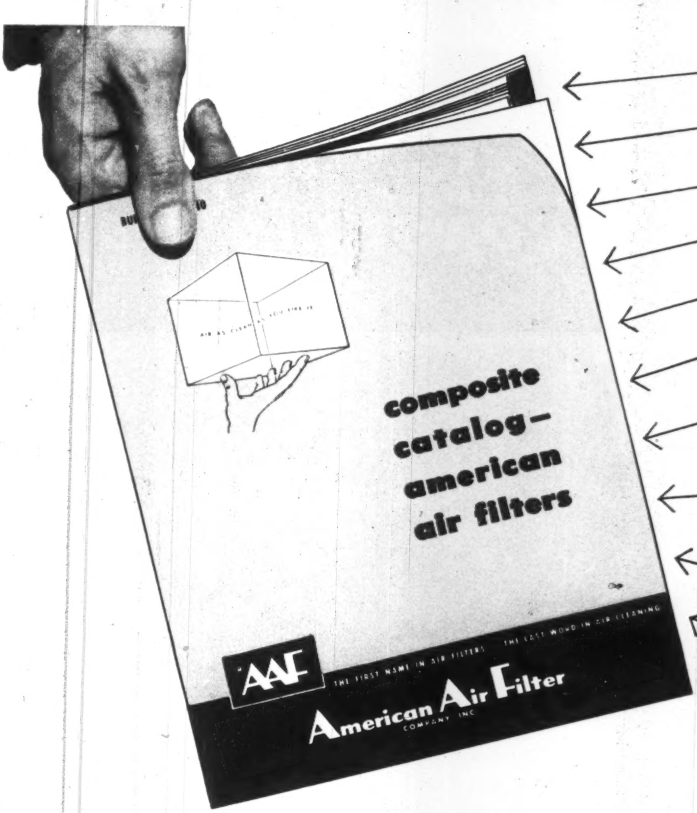


Special machines, built for TRANE (left), balance large fans both statically and dynamically. Above is a balancer for smaller size wheels.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . . Toronto
Offices in 80 U. S. and 14 Canadian Cities

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT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...for Engineers and Executives responsible for air filtration.

It's just off the press and free for the asking. The new COMPOSITE CATALOGUE—AMERICAN AIR FILTERS is a valuable reference work that was three years in preparation. Its thirty-two pages cover essential information on fifteen basic filter types with engineering data, dimension and capacity charts, tables, and installation-maintenance section. Also includes condensed sections on "Air Filter Efficiency" and "Size and Characteristics of Air-Borne Solids". Liberally illustrated and specially indexed for ready reference this Composite Catalogue is designed to save your time.

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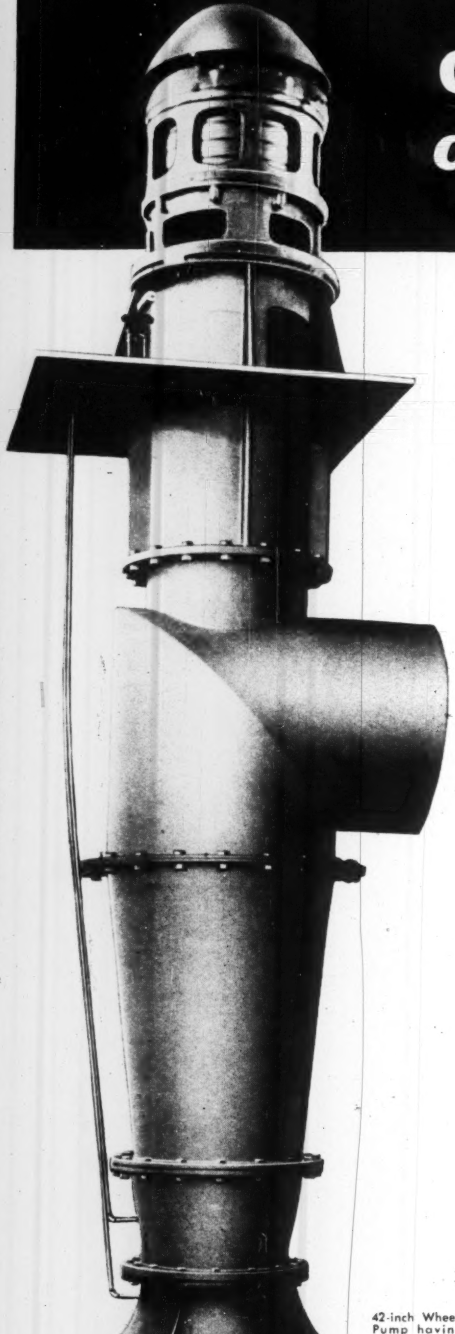


42-inch Wheeler-Economy Vertical Axial Flow Pump having capacity of 40,000 G.P.M.

Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company have consolidated engineering and manufacturing facilities in C. H. Wheeler's plant at Philadelphia. Facilities are now being expanded through new construction and the installation of additional modern machine tool equipment.

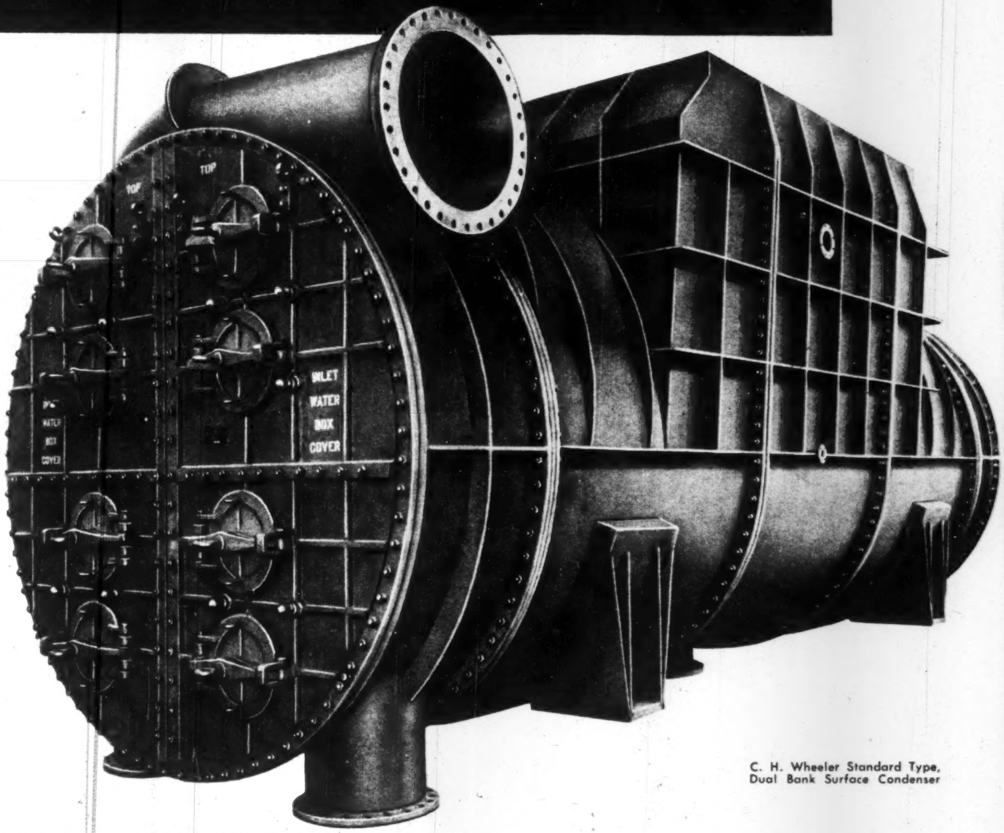
PUMPS . . . Economy has for many years been among the leaders in the engineering and manufacture of centrifugal, axial and mixed flow pumps. Today, the Wheeler-Economy line is one of the most modern and complete in the pumping industry.

CONDENSERS & POWER PLANT EQUIPMENT . . . The C. H. Wheeler Manufacturing Company has contributed many of the outstanding developments in the field of condensing apparatus and vacuum problems. Nearly a decade ago, C. H. Wheeler adopted Economy mixed flow pumps for use with their condensers.

PROCESS EQUIPMENT . . . C. H. Wheeler is also internationally known for Cooling Towers, Steam Jet vacuum apparatus and Fine Particle Reduction Mills, vital links in modern chemical and food processes. Wheeler-Economy Pumps will round out the company's services in these fields.

MARINE GEAR . . . C. H. Wheeler's Marine Gear, Condenser and Deck Machinery department will be augmented by Wheeler-Economy Pumps designed for marine application.

ECONOMY PUMPS, Inc.
SERVE YOU BETTER . . .



C. H. Wheeler Standard Type,
Dual Bank Surface Condenser

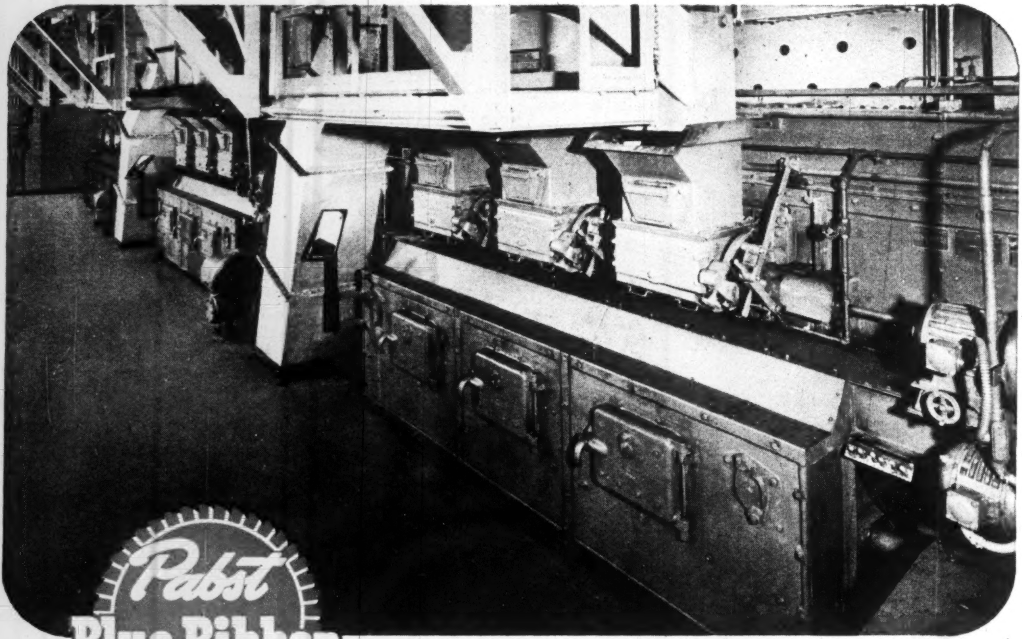
WHEELER-ECONOMY PUMPS

. . . a new name combining old names that have been known and respected for generations. All the experience and metal working techniques this consolidation brings together are of great importance to you — our customer. Wheeler-Economy Pumps will fill your every requirement regardless of size or problem involved. Write to Philadelphia or to the nearest Economy or Wheeler representative listed in the phone directories of principal cities.

113

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. · DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.



Pabst Blue Ribbon

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See Detroit RotoGrate Stokers in Pabst Brewing Company's new Milwaukee Boiler Plant. • Stone & Webster Engineering Corporation, Engineers.

Pabst Blue Ribbon
"HAS"
DETROIT ROTOGRATE STOKERS

"What'll you have?" . . . "Pabst Blue Ribbon!" is a well known slogan. They "have" Detroit RotoGrate Stokers in their new Milwaukee plant, selected for their efficiency and dependability.

The RotoGrate is an advanced spreader stoker with forward moving grates that discharge the ash continuously at the front. The RotoGrate burns any type of Bituminous coal or Lignite and handles fluctuating loads without loss of pressure. All the steam you want when you want it, because of high burning rates that are possible. 4473

INVESTIGATE THE DETROIT ROTOGRATE STOKER

DETROIT STOKER COMPANY
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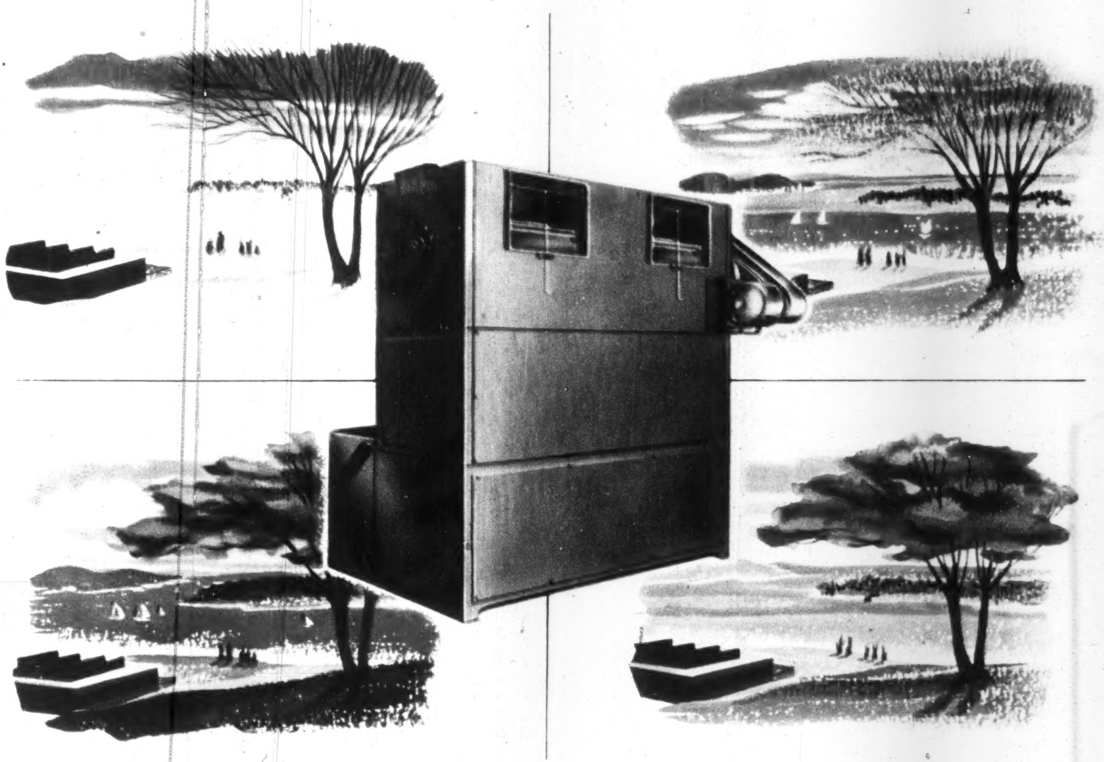
American Blower – a time-honored name in air handling



American Blower Air Conditioning units are designed for summer cooling and dehumidifying and winter heating and humidifying.

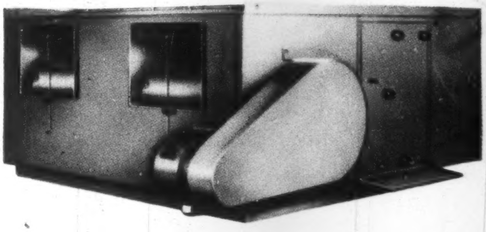
This dual function by the same piece of equipment results in substantial savings in cost and offers much in comfort.

Three types are available: the Type A Conditioner for normal unitary type applications, the Type S Conditioner for unitary type application where washed air or high relative humidities are required, the Type M Conditioner for central system installation.

For data, consult the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION



American Blower Type A Conditioner. Capacities from 1000 to 13,600 cfm. Either direct expanded refrigerants, chilled water, well water or brine can be used for cooling and steam or hot water for heating.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

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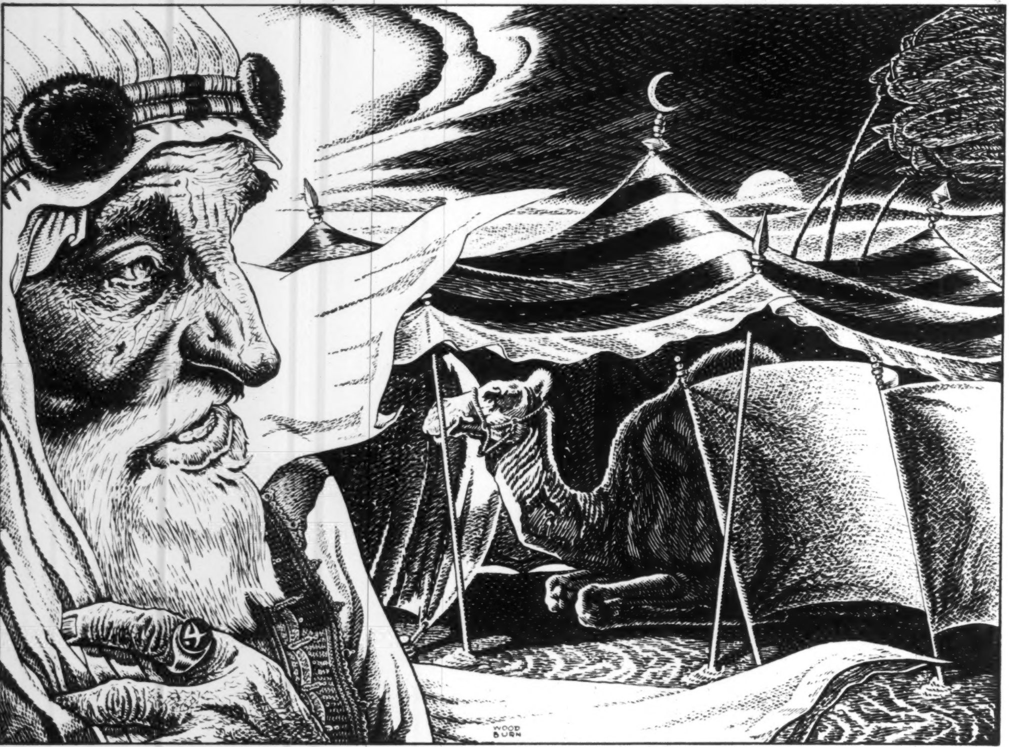

"You may have to stand outside!"

REMEMBER Aesop's fable of the camel and his master--how the kind master allowed the shivering beast to put into the tent first his head, next his shoulders, then his forelegs!

And then the camel said, "Master, I think I ought to come wholly inside," and crowded in. Immediately he said, "There is hardly room for us both, so I think it would be better for you to stand outside so I can turn around and lie down." And without further ado, the camel kicked the man out and took the entire tent.

Men have heard this story for 2,500 years--repeatedly have seen how it illustrates what happens when one man or group of men gain power over others. Men saw it happen in Italy and Germany when Mussolini and Hitler took over. Men saw it happen in Russia.

Even here in America a similar trend is evident. Powerful influences overlook no opportunity, through political manipulation, central controls and bureaucratic regulations, to intrude more and more in our private lives. The situation demands continual, alert watchfulness by all citizens who believe in individual liberty and freedom, to prevent this camel of big government from creeping further into the tent. Before we realize it, "we, the people," the master, may find ourselves "standing outside." In America it is government, which is the servant of the people.

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IS NEEDED

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MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

Century MOTORS

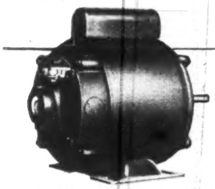
Choose From These Many Types to Fit Your Job

HEAVY-DUTY for Industrial and Appliance Use

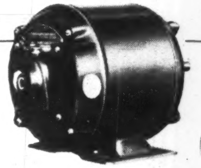
Century Electric Company is celebrating its 50th year in the electrical industry.

From Century's wide range of types and sizes, there's a proper motor for all popular applications. You can be confident that the right Century motor will assure a long life of satisfactory performance.

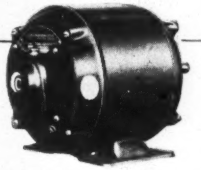
Shown here are examples of Century's line of FRACTIONAL HORSEPOWER motors—ruggedly built for smooth, quiet operation, with a remarkable freedom from vibration



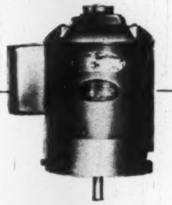
TYPE CSH — Capacitor Start Induction Single Phase Motor suitable where high starting torque and normal starting current is satisfactory.



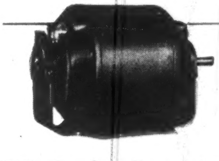
TYPE SP — Split Phase Induction, Rigid Base, Single Phase Motors suitable for light starting duty.



TYPE SC — Squirrel Cage Polyphase Motor built in fractional sizes for all torque requirements.

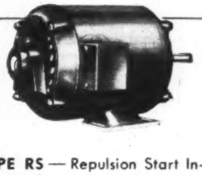


JET PUMP MOTOR—Capacitor Start Single Phase Motor available in sizes for practically every jet pump application.

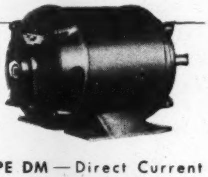


TYPE SP — Split Phase Induction, Cushion Base, for quiet operation.

OIL BURNER MOTOR especially designed for this service. Compact, rugged; smooth, quiet starting and running.

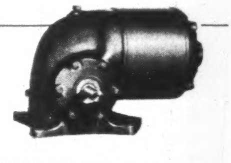


TYPE RS — Repulsion Start Induction Single Phase Brush Lifting Motor suitable for applications requiring high starting torque and low starting current.



TYPE DM — Direct Current built in sizes and ratings for applications where direct current is available or its use desirable.

UNIT HEATER MOTOR provides smooth, quiet performance throughout a long service life.



GEAR MOTOR, compact, rugged, ball bearing equipped, for your high torque, slow speed requirements.

The complete line of Century motors includes a wide range of types and kinds, from 1/8 to 400 horsepower. They are available in open rated, splash proof, totally enclosed fan cooled and explosion proof frames.

Specify Century motors for all your electric power requirements.

CENTURY ELECTRIC CO.
1806 Pine Street
St. Louis 3, Missouri

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Up a tree for steel?

Let us try to help you! We know how tough the search for steel can be. But, we have helped many steel buyers, either by recommending an alternate material that fits their needs, or by suggesting a production change that permits them to use a wider range of steels. Call a U. S. Steel Supply salesman *first* when you are up against a steel supply problem.

SCRAPPY SAYS:
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MORE SCRAP
TODAY...
MORE STEEL
TOMORROW

UNITED STATES STEEL SUPPLY DIVISION
UNITED STATES STEEL COMPANY

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UNITED STATES STEEL

LOOKING AHEAD . . .

NEB BURNAM, *Editor*

1952 seems to be quite an anniversary year. In addition to the "centennial of engineering," it marks the 50th birthday of air conditioning. Also, just 100 years ago Lord Kelvin proposed the heat pump.

Speaking of Lord Kelvin's idea, we ran an article in our March 1945 issue under the title, What's Holding Back the Heat Pump? We don't think this one article was entirely responsible for the great amount of development and application of the heat pump principle in recent years, but we do feel it had some effect . . . and that it does demonstrate the "editorial leadership" for which HP&AC has become widely known.

* * * * * * * * * * *

We particularly enjoy publishing our Question of the Month department. It always includes a new question—one actually asked by a reader with a particular problem to solve (general interest, of course)—and answers to previously published questions. Answers are contributed by other readers who have solved the same problem, or who have helpful information. It's an extremely practical and to-the-point feature on a wide variety of subjects.

As a typical example of how the thing works—and of how darn nice engineers and contractors are in helping each other—we'd like to mention the matter of ventilation and exhaust of diesel locomotive repair shops, a subject covered in Question of the Month for the past two or three issues. The question was asked us by an engineer with one of the major railroads, and published in November HP&AC.

In January there were three replies, each with helpful dope. One came from a reader at an Army laboratory, another from a reader at a shipyard, the third from a manufacturer with considerable experience.

In February, the man who asked the question commented on the replies and gave further information on his particular situation.

And in March, the steam heat and water service engineer for another major railroad describes his method to solve the same problem—a method which worked out "very satisfactorily" in actual operation.

We think it's wonderful that those with information to help the other fellow (and no "axe to grind") take the time and trouble to do it. We get a big kick out of running this "idea exchange" in HP&AC's pages each month.

in Heating

Some interesting and unusual methods are being used to heat one of the big new central power stations now under construction. The novel scheme—which utilizes waste heat—has been tried successfully, but as yet all details have not been completely worked out. However, so that you'll have an early explanation of the installation, an engineer with the utility company is now preparing an article for publication in HP&AC. He will also do an article for us on the power station ventilation, which involves some ducts of pretty fair size.

in Air Conditioning

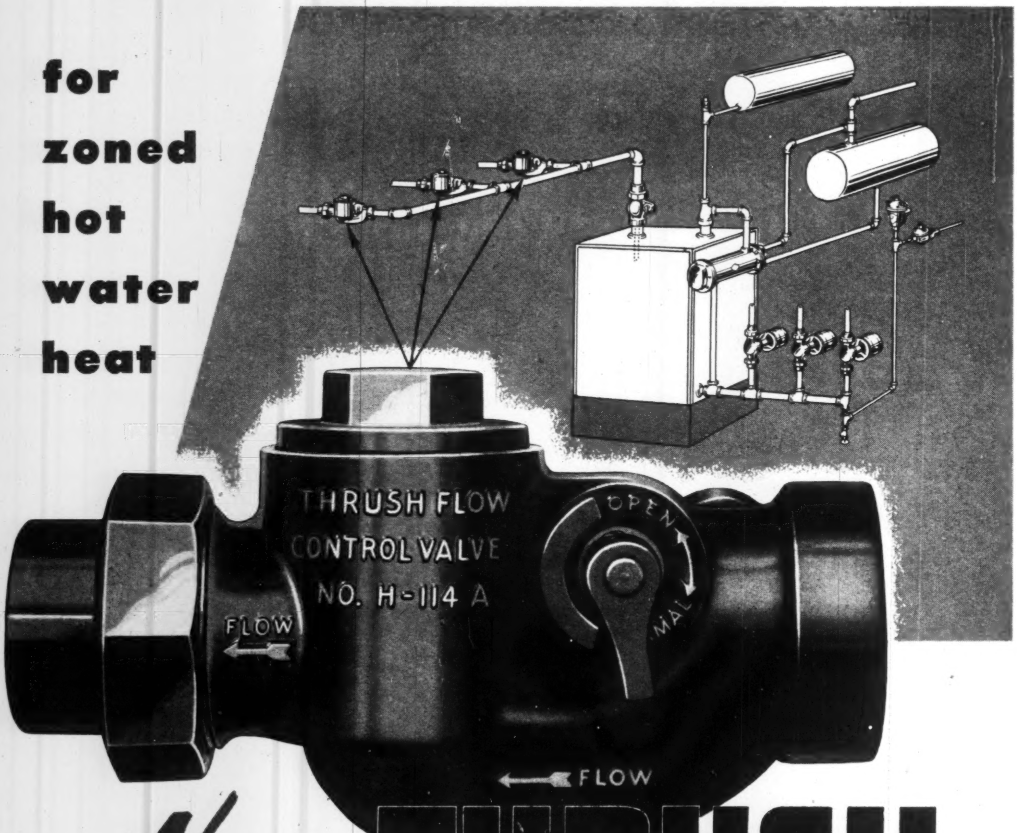
So that the next President of the United States may be chosen cooley and in comfort, the Amphitheatre in Chicago where both the Republican and Democratic conventions will be held this summer is being air conditioned. We had a few paragraphs—an exclusive story—on it in January. The designer of this air conditioning installation is preparing an article for HP&AC giving full engineering details, which are interesting because of the size and nature of the structure, and because of the unique installation methods employed.

in Piping

Coming piping articles cover this highly important subject from many angles. One series which we are looking forward to—and which we hope will be ready before long—is an extensive discussion by an engineer whose previous piping articles in HP&AC were very favorably received by our readers. According to present plans, this series will really constitute a practical handbook of information, including much source material difficult to find anywhere else.

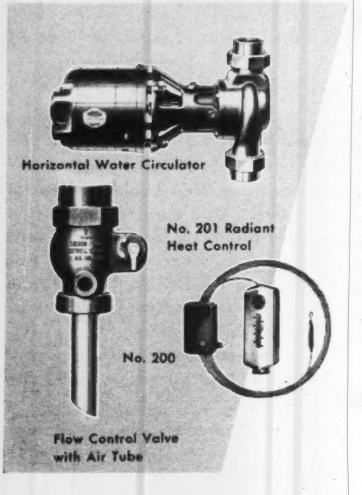
EVERY MONTH.. ***in HP&AC: The Journal Section of The American Society of Heating and Ventilating Engineers . . . Back-of-the-book departments on equipment, trade literature, new books and reports, meetings and conventions, news notes . . . . Sam Lewis' Page, Data Sheet, "Open for Discussion", The Law and Your Profits, The Editor's Pages.***

for zoned hot water heat


THRUSH FLOW
CONTROL VALVE
NO. H-114 A
FLOW
OPEN
MAL
FLOW

the *New* THRUSH

HORIZONTAL FLOW CONTROL VALVE

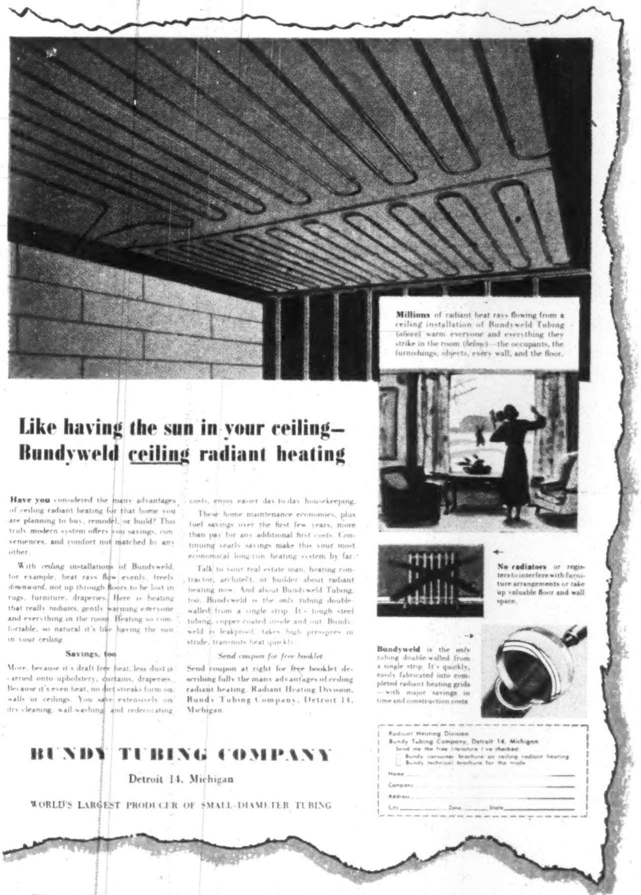

Horizontal Water Circulator
No. 201 Radiant Heat Control
No. 200
Flow Control Valve with Air Tube

HERE'S THE valve you need for zoning hot water heat. Just the thing for low basements. It saves pipe, simplifies installation and gives more head room . . . especially important on long runs. As the illustration shows, this valve feeds straight out from the main and saves several inches of head room over angle type valves. There's a Thrush Flow Control Valve for every need . . . the line is complete with angle and vertical valves, with or without air tube, and the new horizontal space-saving valve announced here. All have the same time-tested operating principle and working parts. For easy zoning of hot water heat and assured customer satisfaction, install the complete forced circulating Thrush Flow Control System. See your wholesaler today or write Department E-3.

H. A. THRUSH AND COMPANY

PERU, INDIANA

"Choose ceiling radiant heating," says Bundy to future home owners—for you



Millions of radiant heat rays flowing from a ceiling installation of Bundyweld Tubing (*above*) warm everyone and everything they strike in the room (*below*)—the occupants, the furnishings, objects, every wall, and the floor.

Like having the sun in your ceiling—Bundyweld ceiling radiant heating

Have you considered the many advantages of ceiling radiant heating for that home you are planning to buy, remodel, or build? This truly modern system offers you savings, conveniences, and comfort not matched by any other.

With *ceiling* installations of Bundyweld, for example, heat rays flow evenly, freely *downward*, not up through floors to be lost in rugs, furniture, draperies. Here is heating that really *radiates*, gently warming everyone and everything in the room. Heating so comfortable, so natural it's like having the sun in your ceiling.

Savings, too

More, because it's draft-free heat, less dust is carried onto upholstery, curtains, draperies. Because it's even heat, no dirt streaks form on walls or ceilings. You save extensively on dry-cleaning, wall-washing, and redecorating costs, enjoy easier day-to-day housekeeping.

These home maintenance economies, plus fuel savings over the first few years, more than pay for any additional first costs. Continuing yearly savings make this your most economical long-run heating system by far.

Talk to your real estate man, heating contractor, architect, or builder about radiant heating now. And about Bundyweld Tubing, too. Bundyweld is the *only* tubing double-walled from a single strip. It's tough steel tubing, copper-coated inside and out. Bundyweld is leakproof, takes high pressures in stride, transmits heat quickly.

Send coupon for free booklet

Send coupon at right for free booklet describing fully the many advantages of ceiling radiant heating. Radiant Heating Division, Bundy Tubing Company, Detroit 14, Michigan.

No radiators or registers to interfere with furniture arrangements or take up valuable floor and wall space.

Bundyweld is the *only* tubing double-walled from a single strip. It's quickly, easily fabricated into completed radiant heating grids—with major savings in time and construction costs.

Radiant Heating Division
Bundy Tubing Company, Detroit 14, Michigan
Send me the free literature I've checked:
☐ Bundy consumer brochure on ceiling radiant heating
☐ Bundy technical brochure for the trade
Name
Company
Address
City Zone State

BUNDY TUBING COMPANY
Detroit 14, Michigan
WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING

First ad in new national campaign directed to future home owners.

Advantages of Bundyweld Tubing

Bundyweld is the only tubing double-walled from a single strip. It's steel, copper brazed through 360° of wall contact, copper-coated inside and out. It gives perfect radiant heating performance. Bundyweld transmits heat quickly. It's leakproof. Its smoothness and freedom from scale promote unimpeded water flow.

Bundyweld gives major fabrication savings, too. Bundyweld comes in 20' lengths for easy handling, one end expanded (when specified) for easy joining. Ductile Bundyweld bends easily on simple fixture. Lightweight, rigid grids of Bundyweld are easily, quickly mounted on ceiling.

It is the conviction of Bundy Tubing Company that radiant heating systems rightly belong in *ceilings.*

Bundy tells future home owners *why* in an intensive, full-page, four-color campaign appearing in *Better Homes and Gardens* and *American Home*—magazines carrying immense weight with consumers interested in buying, building, or remodeling homes.

Are you ready?

Interest in radiant heating has spurted sharply upward since the end of World War II. The all-new Bundy campaign is designed to give future home owners important information on *ceiling* radiant heating and on the Bundyweld Tubing features that help assure a perfect, long-lasting, economical system.

This campaign, of course, will help pave the way to even stronger consumer acceptance of ceiling radiant heating and Bundyweld Tubing. Result for architects and builders: Those who offer Bundyweld ceiling radiant heating systems will have a powerful, convincing, and much-wanted sales feature to speed sales to receptive buyers. Result for plumbing and heating contractors: Continually increasing business and good, sound profits from the installation of Bundyweld ceiling radiant heating systems.

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

The Bundy consumer brochure on ceiling radiant heating, to be offered in every national radiant heating ad, was written with you in mind, too. Let us send you a copy. It's packed with meaty facts.

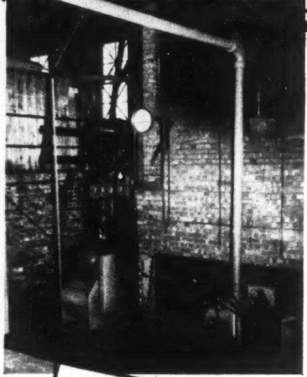
Radiant Heating Division
Bundy Tubing Company, Detroit 14, Michigan
Send me the free literature I've checked:
☐ Bundy consumer brochure on ceiling radiant heating
☐ Bundy technical brochure for the trade
Name________________
Company________________
Address________________
City________ Zone______ State________

"We 'educated' our College Heating Plant...

with a modern coal installation we saved more than a third of our fuel bill,"

says Mr. James Gribben, Chief Engineer of Bethany College, Bethany, West Virginia.

"Colleges watch operating costs as closely as any business firm—and one big item for our college is the heating bill. That's exactly why Bethany went to the expense of putting in new coal heating equipment! Our old system supplied heat for sixteen buildings—to the tune of 2,600 tons of coal a year. Our new installation, with its automatic stoker, does the same job using only 1,650 tons. That's a fuel saving of 38.9%! Our eyes certainly have been opened to the efficiency and economy of *bituminous* coal—especially when it's burned with modern equipment."



Here's Bethany's new boiler room, showing the pipe of the automatic stoker. **THIS MODERN EQUIPMENT WILL PAY FOR ITSELF, THROUGH FUEL SAVINGS ALONE, IN LESS THAN TWO YEARS!**

Modern combustion installations can add anywhere from 10% to 40% to the energy obtained from the same amount of coal in years gone by. Great advances have been made in coal- and ash-handling equipment, too—cutting labor costs—making coal as clean and convenient to use as any fuel.

If you're planning to modernize your present installation—or thinking of building a new plant, call in a competent consulting engineer. He'll show you how a modern coal system designed to meet your specific needs can save you money and serve you better!

And don't forget—you'll always be able to get the coal you need. America's coal industry is the most efficient in the world. America's coal reserves are ample for centuries to come. Right now and for the future, too, coal users can be assured of a dependable fuel supply at reasonable prices.

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
Washington, D. C.

If you're running your own steam plant —for heat or for power—you just can't afford to ignore these facts!

COAL *in most places is today's most economical fuel.*

COAL *resources in America are adequate for all needs—for hundreds of years to come.*

COAL *production in the U.S.A. is highly mechanized and by far the most efficient in the world.*

COAL *prices will therefore remain the most stable of all fuels.*

COAL *is the safest fuel to store and use.*

COAL *is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.*

FOR HIGH EFFICIENCY *FOR LOW COST*

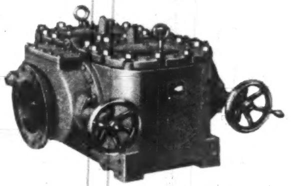
YOU CAN COUNT ON COAL!

ZURN

OUR 50th ANNIVERSARY

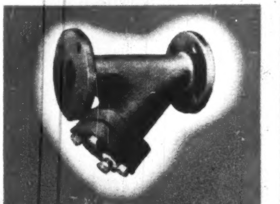
STRAINERS
IMMEASURABLY IMPROVE
THE HANDLING OF FLUIDS
(WATER, OIL, CHEMICALS)
THROUGH PIPE LINES

These Strainers Permit HIGH *Rates of Flow* With Remarkably LOW *Pressure Drop* From Input to Output

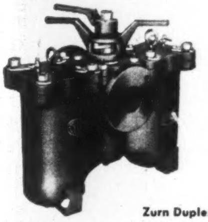


Zurn Duplex Multi-Basket Strainer.

Zurn Sinlex Strainer. Available in offset and straight-through types.

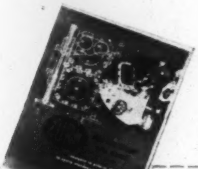


Zurn "Y" Type Strainers available in any cast material and for high pressures.



Zurn Duplex Plug Valve Strainer.

Write for Pipe Line Strainer Manual No. 951, including previously unpublished pressure drop data.



Zurn Strainer applications include Municipal Water Systems, Process Industries, Ships, Power Stations, Industrial Plants and High Temperature Installations. Zurn Engineers are available for consultation on all fluid handling problems.

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In Canada: Canadian Zurn Engineering Ltd., Montreal, P. Q.

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Industrial Division; Erie, Pa., U. S. A.
Please send me Pipe Line Strainer Manual No. 951
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Position____________________
Company____________________
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City__________ State__________
Please attach to your business letterhead—Dept. HP

IT HEATS
IT COOLS

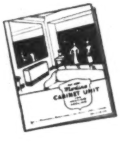
IDEAL FOR STORES, SHOWROOMS, SCHOOLS, BANKS,
HOTELS, HOSPITALS, THEATERS, CHURCHES, OFFICES, VESTIBULES
AND OTHER COMMERCIAL AND PUBLIC BUILDING AREAS

A remarkably useful unit with dozens of applications

MODINE Cabinet Units meet the requirement for fast, positive and quiet distribution of heated or cooled air — where the expense and elaborateness of unit ventilators or air conditioners are not warranted.

Models for heating with steam or hot water . . . cooling with chilled water. Cooling models may be used for *both chilled water cooling and hot water heating.*

Exceptionally attractive in appearance and versatile in application, Modine Cabinet Units offer many interesting possibilities for new buildings and remodeling jobs. Available in five sizes from 120 to 640 Edr.

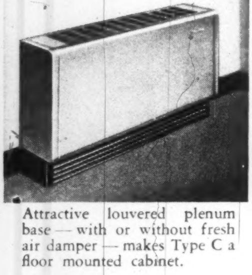


GET FREE ILLUSTRATED BULLETIN 550 TODAY and find out how you can profitably use Modine Cabinet Units. Call your Modine representative listed in the classified section of your phone book. Or write direct to Modine Manufacturing Company, 1509 DeKoven Ave., Racine, Wis.

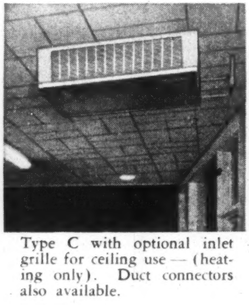
Modine
CABINET UNITS
FOR HEATING & COOLING

C-1145

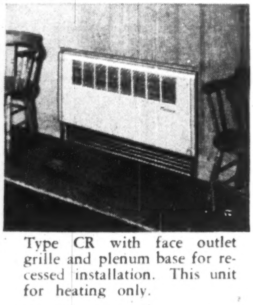
Type C — basic Modine Cabinet Unit for wall mounting where off-the-floor installation is desired.



Attractive louvered plenum base — with or without fresh air damper — makes Type C a floor mounted cabinet.



Type C with optional inlet grille for ceiling use — (heating only). Duct connectors also available.



Type CR with face outlet grille and plenum base for recessed installation. This unit for heating only.

FOR Fast...Easy AIR FLOW ADJUSTMENT

Check the advantages of the *Vari-Pitch* drive:

1. Takes only a few minutes to change fan speed.
2. Infinite number of speeds.
3. Speed of fan will not change once it's set.
4. Quiet!
5. Costs less than any other method of speed changing, such as multi-speed motors, or special control.
6. Wide range of types and sizes to fit operating conditions. Big or small, Stationary or Motion control types are available.

PLUS VALUES

One phone call brings you everything you need for your drive — motor, base, starter, sheaves, and belts. In addition, you get the extra engineering help in field and factory that comes from Allis-Chalmers long experience. For A-C has made more industrial V-belt drive installations than any other manufacturer.

Get fast, one-call service on your next fan job by calling your nearest Allis-Chalmers Authorized Distributor or Sales Office. Or write for bulletin 20B6082B, Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3597

Sold . . .

Applied . . .

Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

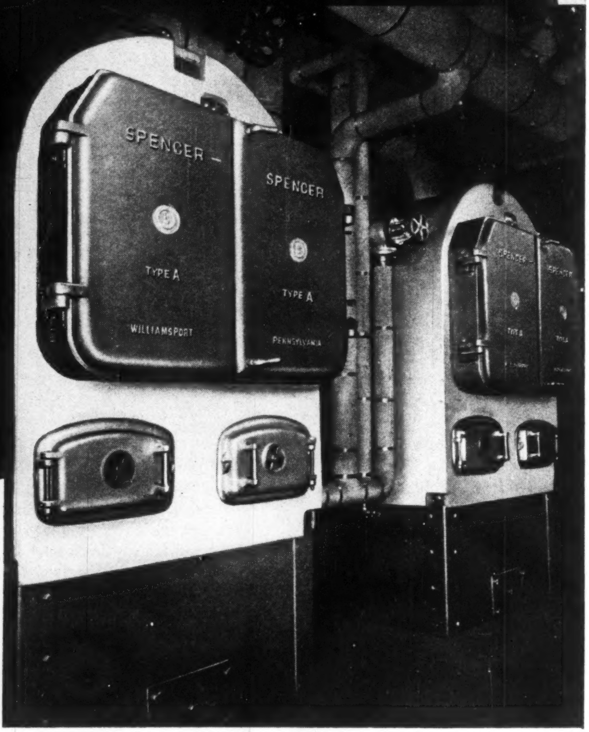
SPENCER

THE QUALITY LINE OF

HEATING BOILERS

You can select from 76 different models, both cast-iron and steel. Versatile, dependable, every Spencer Boiler is backed by more than sixty years of leadership . . . precision engineered and manufactured to give superior, guaranteed service.

Write for Spencer catalogue today.

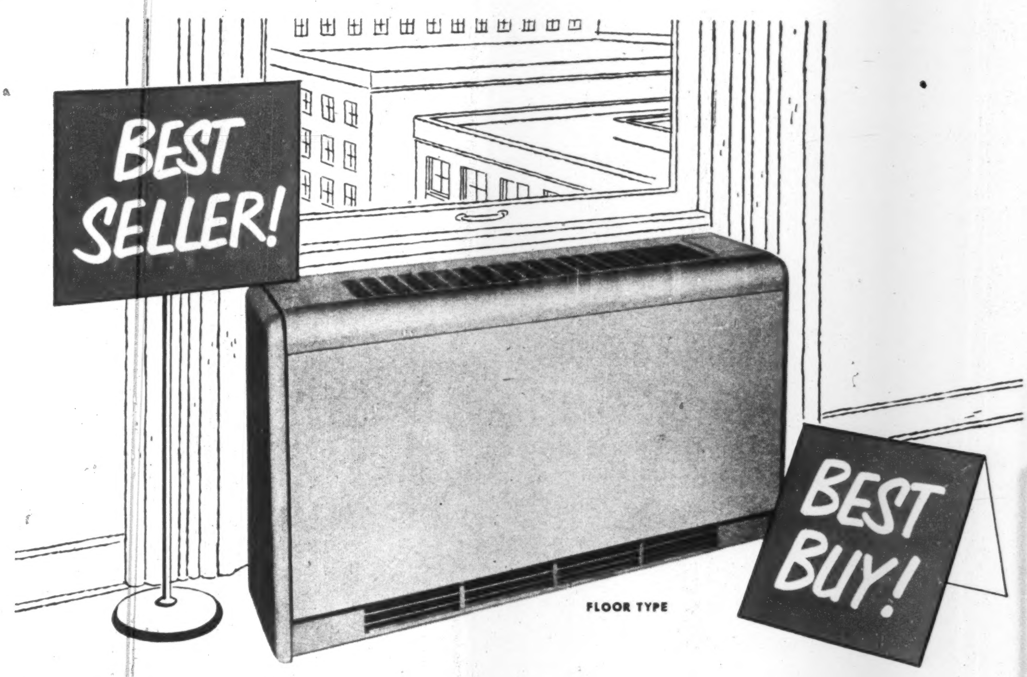


Modern Spencer Boiler installation in the new Montoursville Joint Area High School, Montoursville, Pennsylvania.

Architect: J. E. Boodon, AIA, Williamsport, Pennsylvania. *Heating Contractor:* Joseph Rado Company, Berwick, Pennsylvania.

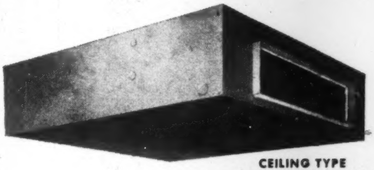
There is a Spencer for every building . . . for every fuel

SPENCER HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA


BEST SELLER!
BEST BUY!

FLOOR TYPE

McQuay SEASONMAKERS



CEILING TYPE
for suspended mounting

INDIVIDUAL ROOM AIR CONDITIONERS

(For use with central chilled water or freon system)

A best seller for you and the best buy for your customer! McQuay Seasonmakers satisfy the demand for individual room comfort. The Seasonmaker's quiet operation and attractive design are welcome additions to any multi-room building.

The Seasonmaker's year 'round performance actually "make the seasons come to you" . . . providing heated, and filtered air in winter; cooled, dehumidified, and filteredair in summer.

Famous McQuay Ripple-Fin coil construction assures long life and dependable service. These units are easy to install and maintain. Available in three sizes and types to fit the requirements of old and new buildings. Write for Condensed Bulletin 700 for full details. Representatives in all principal cities.

BASIC TYPE
for fully recessed installation

McQuay INC.

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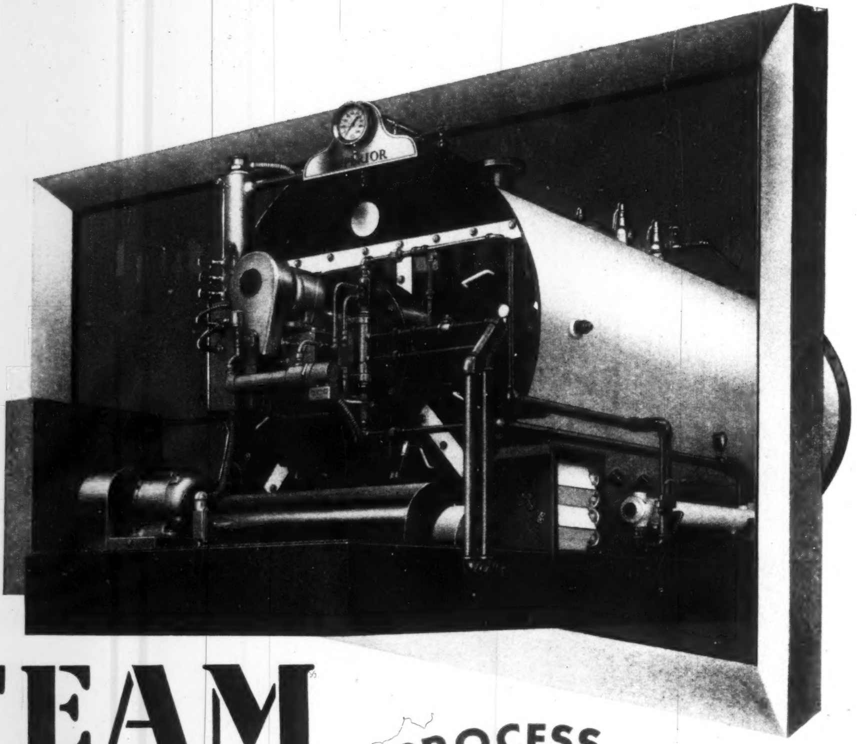
AIR CONDITIONING • REFRIGERATION • HEATING



STEAM

FOR HEAT OR PROCESS

A complete steam plant whose heavy duty construction assures long-lived dependability throughout years of hard usage.

- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides ample heating surface . . . at minimum, 5 sq. ft. b.h.p.
- Built-in induced draft fans provide added safety and eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Burner equipment to suit your fuel; gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.

If you are planning new or additional steam facilities, you'll want Catalog 404 which tells all you should know about packaged steam plants.

for performance you can **BANK** on

SUPERIOR
STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

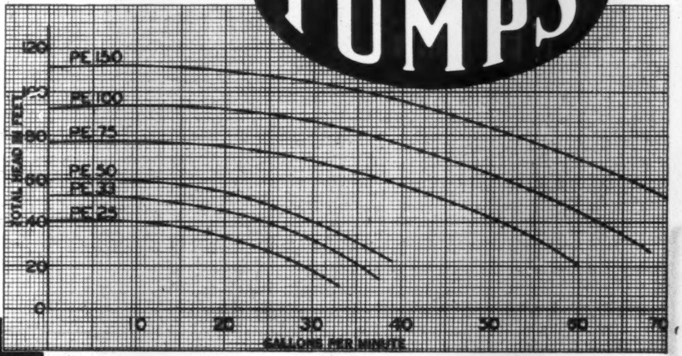
IF IT'S PERFORMANCE YOU WANT

BUY FROM THE PEERLESS *Fluidyne* LINE...

PEERLESS PUMPS

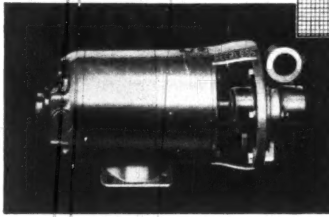
FOR FRACTIONAL HP PUMP USERS

HERE ARE THE RATINGS



HERE'S THE PUMP

PEERLESS *FLUIDYNE* TYPE PE PUMP ¼ TO 1½ H.P.



KEY TO CHART
Performance chart showing head capacity characteristics of Peerless Type PE fractional hp Fluidyne pumps at 3450 rpm

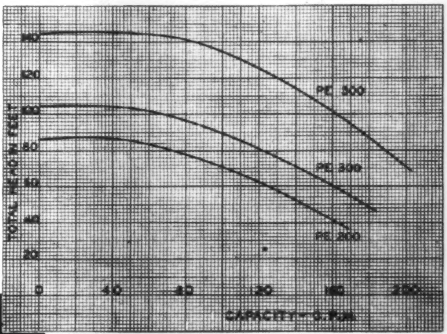
KEY TO PUMP HP
PE 25—¼ hp
PE 33—⅓ hp
PE 50—½ hp
PE 75—¾ hp
PE 100—1 hp
PE 150—1½ hp

Equipped with Mechanical Shaft Seals

COMPACT • ECONOMICAL
DURABLE *and* EASILY SERVICED

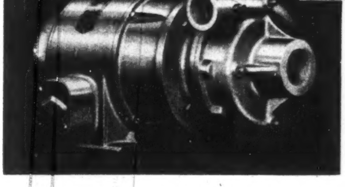
FOR INTEGRAL HP PUMP USERS

HERE ARE THE RATINGS



HERE'S THE PUMP

PEERLESS *FLUIDYNE* TYPE PE PUMP 2 TO 5 HP



KEY TO CHART
Performance chart showing head capacity characteristics of Peerless Type PE integral hp Fluidyne pumps at 3450 rpm

KEY TO PUMP HP
PE 200—2 hp
PE 300—3 hp
PE 500—5 hp

Peerless offers in the Fluidyne line of end-suction horizontals, both electric and pulley-driven or flexible coupled models from ¼ hp to 150 hp. Capacity range: up to 5500 gpm; head range: up to 260 ft. New Bulletin B-2300 describes the line completely.

Mail Coupon Today!

Peerless Pump Division
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, Calif.

Please send without obligation new Bulletin B-2300 describing Fluidyne line of fractional and integral hp pumps.

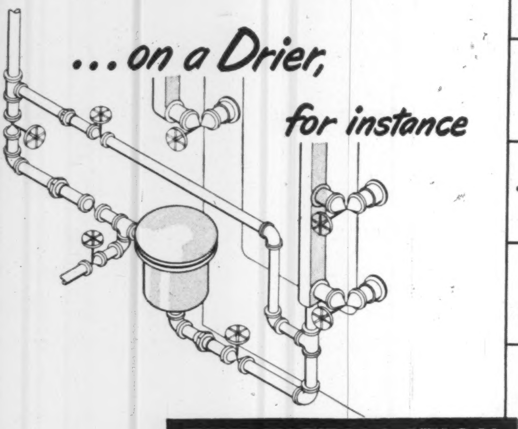
NAME____________________
COMPANY____________________
STREET____________________
CITY__________ STATE__________
HP&AC

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address inquiries to Factories at:
Los Angeles 31, California and Indianapolis 8, Indiana
Offices: New York, Chicago, St. Louis, Atlanta; Dallas, Plainview and Lubbock, Texas; Fresno, Los Angeles; Phoenix; Albuquerque, New Mexico.

PEERLESS PUMPS fmc

Example of Steam Trap Durability

...on a Drier, for instance



THE INSTALLATION

On heavy-duty, steam-heated tumbler-type drier at American Linen Supply Company, Cincinnati.

THE HISTORY

A high discharge capacity trap was needed to operate this drier 16 hours daily under heavy loads, with 125 psi. steam. Specifications called for rapid, fully automatic condensate removal to insure fast warm-ups and a steady flow of hot, dry steam to the drier. Naturally, the lowest possible trap maintenance cost was also wanted.

The choice was a Crane 150-Pound Inverted Open Float Steam Trap, carefully selected for adequate drainage capacity, and above all, properly installed.

In service more than 8 years and never needing any repairs or new parts, the Crane trap has given complete satisfaction. Total maintenance expense: periodic routine inspection only.

TRAP SERVICE RATINGS

SERVICE LIFE:
More than 8 years - Heavy duty

SUITABILITY:
High discharge capacity

MAINTENANCE COST:
None - Routine inspection only

SPECIAL FEATURES:
Simple, dependable mechanism

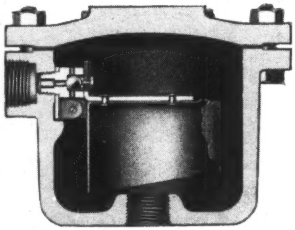
OPERATING RESULTS:
Fast warm-ups - Steady, even heat

PRICE:
Good Buy

AVAILABILITY:
Stock item in Crane line

THE TRAP

Crane Iron Body Inverted Open Float Steam Trap, for 1 to 300 pounds saturated steam working pressures. Small and compact in all sizes, yet has high discharge capacity. Patented ball-type seating gives positive pressure seal. Simple operating mechanism with only one moving unit assures durable, trouble-free performance. See your Crane Catalog or your Crane Representative for complete data on these highly efficient traps.

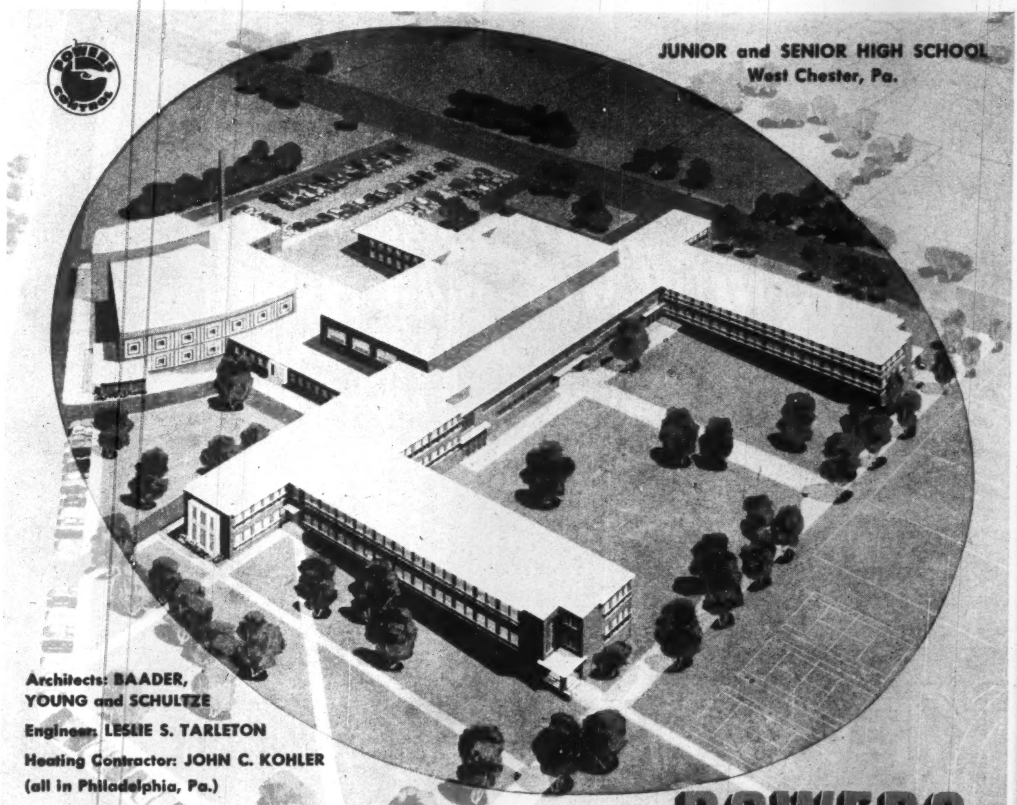


The Complete Crane Line Meets All Valve Needs. That's Why, More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



JUNIOR and SENIOR HIGH SCHOOL
West Chester, Pa.

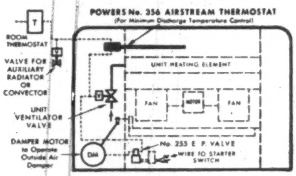
Architects: BAADER, YOUNG and SCHULTZE

Engineer: LESLIE S. TARLETON

Heating Contractor: JOHN C. KOHLER

(all in Philadelphia, Pa.)

Greater SIMPLICITY of POWERS


POWERS No. 356 AIRSTREAM THERMOSTAT
(For Minimum Discharge Temperature Control)
T
ROOM THERMOSTAT
VALVE FOR AUXILIARY RADIATOR OR CONVECTOR
UNIT VENTILATOR VALVE
DAMPER MOTOR to Operate Outside Air Damper
DM
UNIT HEATING ELEMENT
FAN
MOTOR
FAN
No. 255 E. P. VALVE
WIRE TO STARTER SWITCH

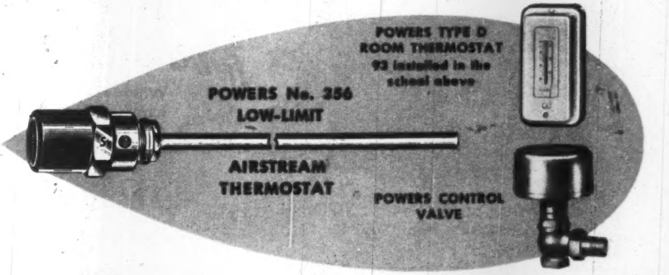
UNIT VENTILATOR CONTROL—used in this attractive modern school—is only one of the features that appeals to operating personnel. Equally important is the continuous accuracy of a Powers Low-Limit Thermostat.

As unit ventilators operate on minimum discharge temperature much of the time, a control system is only as good as its low-limit thermostat. Because of its superior design a Powers instrument needs no auxiliary devices to supplement its dependable operation.

To insure greatest comfort in classrooms regulate unit ventilators with Powers control. Its low cost maintenance and years of accurate service make it a very profitable investment.

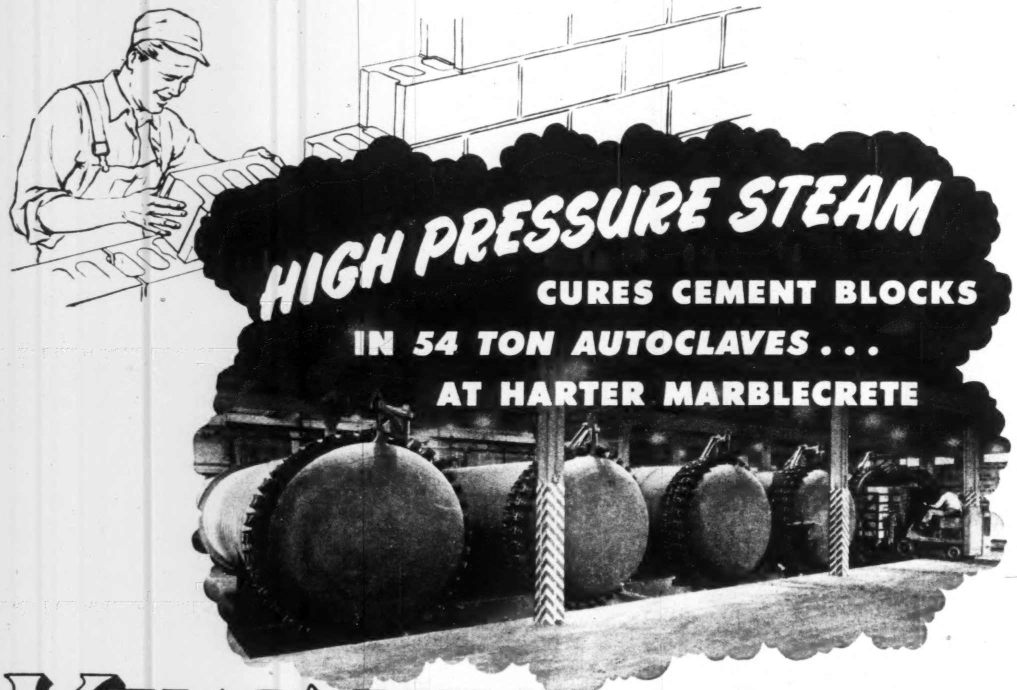
Important Features

- Powers 2-line non-waste Airstream Thermostats have a graduated dial for ease of adjustment—also Adjustable Sensitivity for precise control.
- With its ingenious non-waste double air valve mechanism there is no continuous waste of compressed air. It is not a "leakstat".
- Once set for the proper temperature a Powers No. 356 Thermostat requires no readjustment—there are no fine restrictions to be serviced.


POWERS TYPE D ROOM THERMOSTAT
93 installed in the school above
POWERS No. 356 LOW-LIMIT
AIRSTREAM THERMOSTAT
POWERS CONTROL VALVE

(a80)

Established in 1891 • THE POWERS REGULATOR COMPANY • SKOKIE, ILL. • Offices in Over 50 Cities

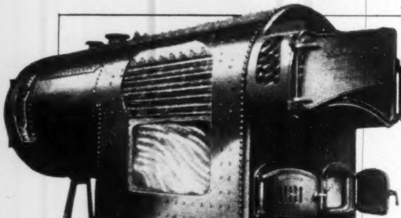


KEWANEE HEAVY-DUTY BOILER

- In the modern plant of Harter Marblecrete Stone Co., at Oklahoma City, cement blocks are cured with high-pressure steam at 135 to 150 psi in five of the *largest autoclaves ever built.* (Pictured above)

A further interesting fact about this outstanding development is the use of a 26-inch vacuum, pulled with an Elliott barometric condenser, for the drying stage.

High pressure steam is provided by a gas fired 300 hp Kewanee Boiler producing 10,500 pounds of steam per hour.



Cut-a-way View of KEWANEE "500" used in Harter Marblecrete Plant. Sizes for 40 to 304 hp . . . 100-150 psi.

FOR HEATING, POWER AND INDUSTRIAL PROCESS STEAM

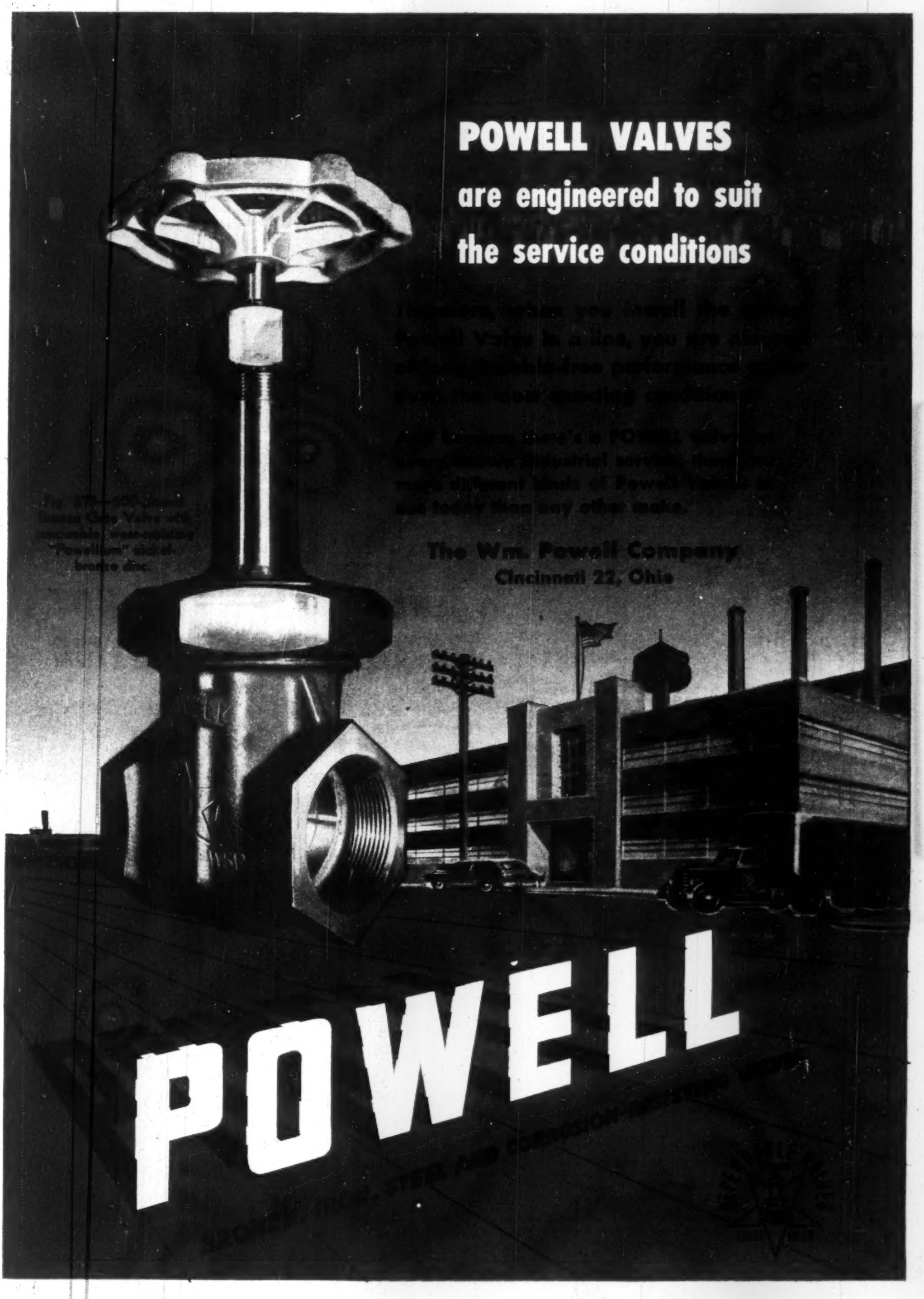
Wherever steam is needed . . . *high or low pressure* . . . there is a Kewanee Boiler just right. Ask for complete catalogs and information.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary corporation

KEWANEE BOILERS

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · ACME CABINETS · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON



POWELL VALVES
are engineered to suit the service conditions

Therefore, when you install the right Powell Valve in a line, you are assured of long, trouble-free performance under even the most exacting conditions.

And because there's a POWELL valve for every modern industrial service, there are more different kinds of Powell Valves in use today than any other make.

The Wm. Powell Company
Cincinnati 22, Ohio

Fig. 375—200-Pound Bronze Gate Valve with renewable, wear-resisting "Powellium" nickel-bronze disc.

EQUA = TEMP BALANCING VALVES...

You can drain, vent or shut off individual zones in a radiant heating system with EQUATEMP* balancing valves. A butterfly-type disc, fitted with a leak-proof synthetic rubber "O" ring, shuts off tight when the valve is closed.

EQUATEMP* may be regulated by using either Allen-type wrenches or the handy key provided. For convenience, EQUATEMP* can be installed in upright position for installation near the floor, or inverted for overhead or ceiling installation.

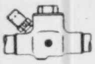


FIGURE 1

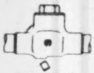


FIGURE 2

VENTING OR DRAINING IN UPRIGHT POSITION. Figure 1. Automatic vent installed in top drain. Figure 2. Bottom drain plug removed for draining of system. Valve may be operated with key from above.

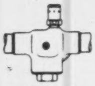


FIGURE 3

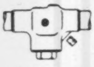
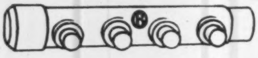


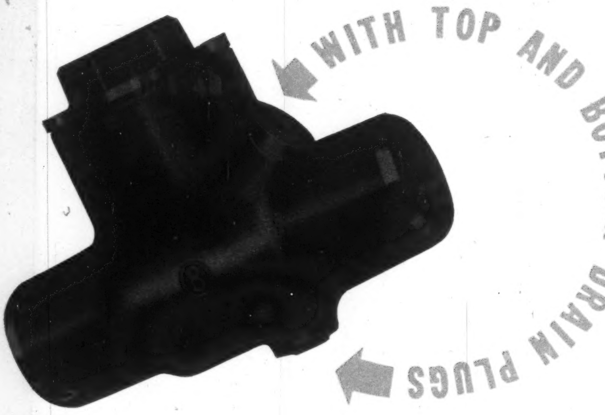
FIGURE 4

VENTED OR DRAINING IN INVERTED POSITION. Figure 3. Automatic vent installed in the bottom drain. Figure 4. Top drain plug removed for draining of system. Valve may be operated with key from below.



EQUATEMP MANIFOLD FITTINGS in combination with Equatemp solder-type valves are the time-saving and economical way to balance hot water radiant systems. Available with either three or four outlets, they can be combined to form manifolds of any desired length.

For additional information, contact your local distributor of Ohio Brass Valves or send in coupon below.



A NEW VALVE FOR HOT WATER RADIANT HEATING

You can install this valve anywhere. Upside down or right side up, EQUATEMP* can be operated in any position. Two removable plugs are built right into the valve as shown above. You can install any one of several standard venting devices in place of the top plug, or you can drain the system simply by removing the bottom drain plug.

Use EQUATEMPS the next time you install a balanced radiant heating system. EQUATEMPS are available for use on $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{3}{4}$-inch tubing and on $\frac{3}{4}$-inch threaded pipe.

* TRADE-MARK

OHIO BRASS COMPANY
MANSFIELD, 3, OHIO

Please send me EQUATEMP circular 1214-V

Name ....

Company ....

Street ....

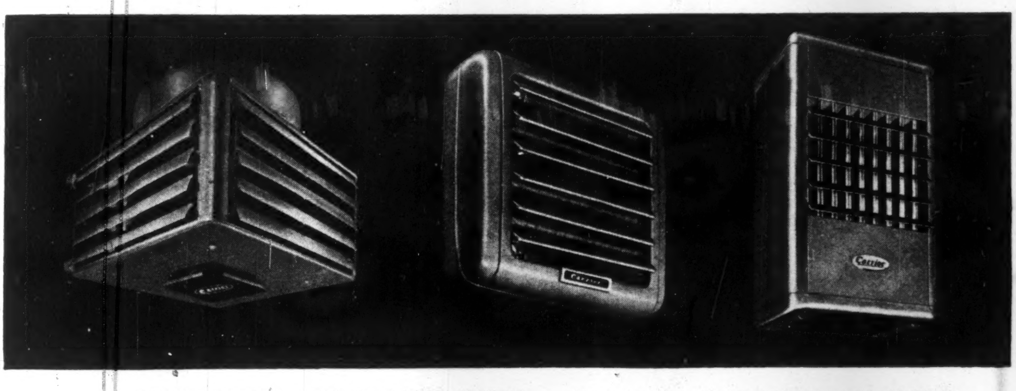
City .... **State** ....

4208-V

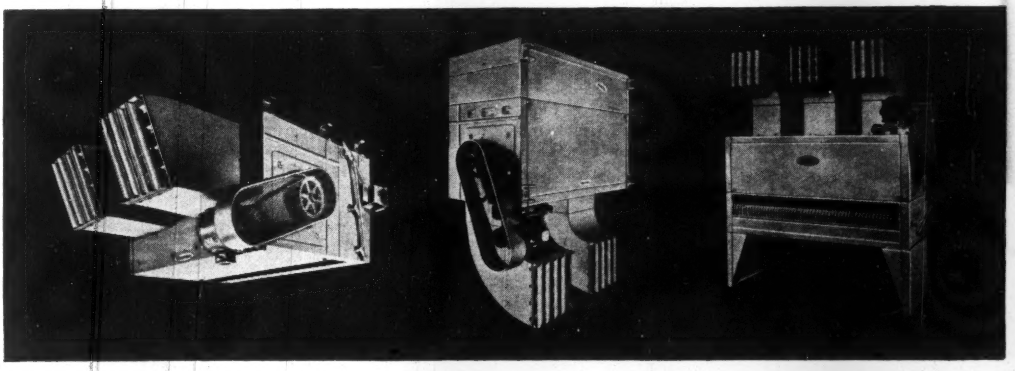
Ohio Brass
VALVES
OHIO BRASS COMPANY, MANSFIELD, OHIO

Carrier heats big buildings or small

Any size space can be heated efficiently, economically, with Carrier heating equipment



CARRIER PROPELLER-FAN TYPE UNIT HEATERS. *Four-way, Directed-flo vertical model 46S* discharges warmed air in 1, 2, 3 or 4 directions, at any angle, in any quantity. Gives quick heat from higher ceilings. 7 sizes: 82,000 to 500,000 Btu's. Steam or hot water. *Horizontal model 46U* is attractive, quiet, rugged. Ideal for wall installations. Single-row Aerofin heating coil with widely spaced fins offers less air resistance, makes cleaning easier. 10 sizes: 21,000 to 200,000 Btu's. Steam or hot water. *Gas-fired models 46T, shown, and 46TD (duct type)* supply clean, economical heat wherever gas is available—offices, factories, stores, etc. Both feature one-piece heat exchanger and combustion chamber of Aluminized Steel. 7 sizes: 70,000 to 230,000 Btu's. AGA-approved for all types of gas. *Write Carrier Corporation, Syracuse 1, N. Y., for the folder, "Unit Heaters."*

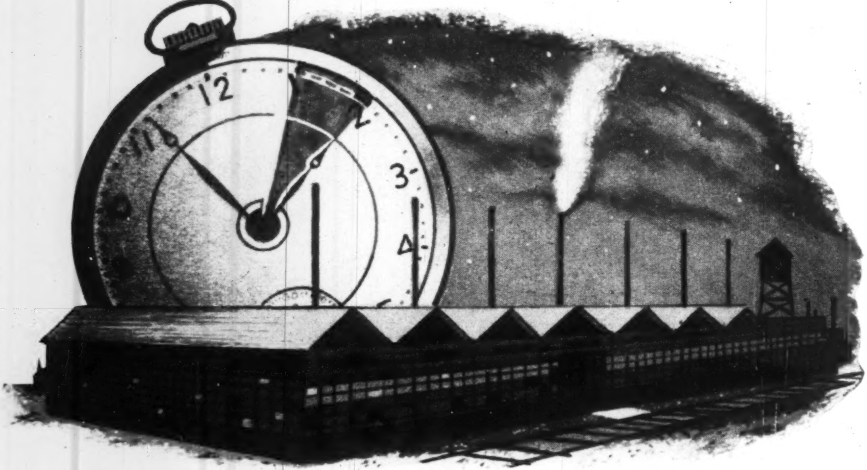


CARRIER BLOWER TYPE HEAT DIFFUSERS 46P,Q,R heat and ventilate larger enclosed areas in garages, hangars, warehouses, factories, etc. Multiple discharge outlets with adjustable louvers deliver air in practically any direction. Floor, wall or ceiling mounted. Sectionalized for easy handling—quickly altered to fit changing requirements. 7 sizes, to 1,720,000 Btu's. Air-handling capacities from 4000 to 25,000 cfm. Steam or hot water.

The Unit Heater Industry is proud of the recognition accorded it by the armed services and procurement departments of the United States Government. Proven in grueling use during World War II, unit heaters are now standard equipment in ships, plane hangars, living quarters, garrison buildings—wherever reliable, efficient heat is necessary for the completion of a task or the well-being of our fighting forces. On the home front, unit heaters serve equally important roles in industrial plants producing war material supplying the needs of the allied forces.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING



How to reduce DOWNTIME with STEAM TRAPS

What do you expect from your steam traps? To drain condensation . . . to vent air, and to prevent the escape of live steam?

Any good trap can do this job. But what about that other important factor, keeping those vital steam lines operating continuously?

The careful design and exclusive construction of Super-Silvertops prevents costly downtime in two ways.

First, rugged and strong . . . they eliminate downtime caused by the continual replacement of parts in steam traps. Super-Silvertop valves and seats are made of longer lasting Anderloy* alloys . . . and the bucket is guided on a patented center tube that eliminates bucket damage.

Second, well designed . . . they reduce downtime because they are much faster to install and inspect. Three pipe connections in the head permit the trap to be installed straight-in-line or as an elbow . . . saving 50 minutes whenever a trap is installed . . . 30 minutes whenever serviced.

Thousands of leading refineries, food processing, chemical and other industrial plants have saved hours of downtime with Super-Silvertops. You can too.

Get the complete story today . . . send for a copy of Solving Steam Traps Problems. Mail Coupon.

USE STRAIGHT-IN-LINE OR AS AN ELBOW

SUPER-SILVERTOPS SAVE MONEY

THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland 2, Ohio

Gentlemen: Please send without obligation your book "Solving Steam Trap Problems."

Name ______________________________

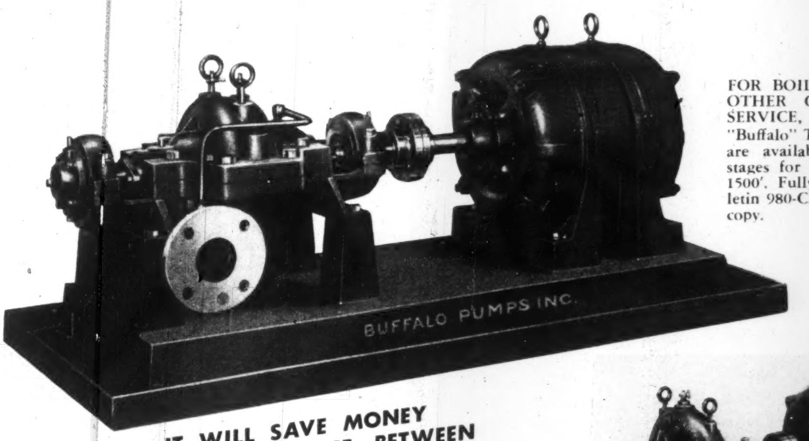
Address ______________________________

City ____________________ State ____________

In Canada: Bawden Machine Co., Toronto

"Buffalo" Tips on Better Pumping

IT'S IMPORTANT TO CHOOSE THE RIGHT CAPACITY



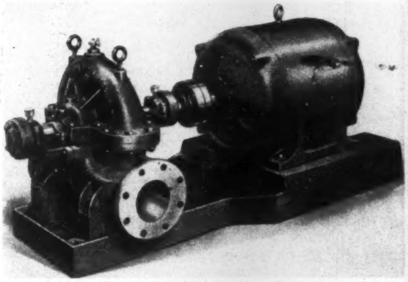
FOR BOILER FEED AND OTHER CLEAR WATER SERVICE, "Buffalo" Type "RR" Pumps are available in 2 and 4 stages for heads as high as 1500'. Fully described in Bulletin 980-C. Write for your copy.

- IT WILL SAVE MONEY
- IT MEANS THE DIFFERENCE BETWEEN DISAPPOINTMENT AND SATISFACTION

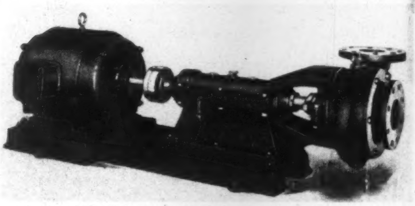
Picking a pump well over the required size "just to be sure" can be a needless expense, both in first cost and driving power. The right capacity can be determined with little trouble, for both present and future needs.

Contrary to popular belief, centrifugal pumps are not rated solely on gallons per minute, at so many pounds per square inch pressure. Rather, they move pounds per hour of liquid through a specified hydraulic gradient. Thus, specific gravity of the liquid, as well as discharge head in feet, and gallons per minute, must be specified.

Giving your pump supplier all possible information as to hydraulic conditions will result in the best selection of a pump for your job. "Buffalo" builds centrifugal pumps in the capacities you need and in the design you need to make your pump investment most satisfactory to you.



Above, "Buffalo" Double Suction Pumps are high quality clear water pumps often used in air conditioning service. In capacities up to 10,000 gpm. Write for Bulletin 955-N.



Above, "Buffalo" Full Ball Bearing Pumps for handling hot water with low submergence on suction, or with suction lift up to 25' handling cold water. Bulletin 976-D.

"Buffalo" PUMPS

BUFFALO PUMPS INC.

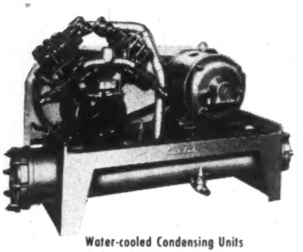
171 MORTIMER STREET BUFFALO, NEW YORK
Canada Pumps Ltd., Kitchener, Ont. *Sales Representatives in All Principal Cities*

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Curtis

DISTRIBUTORS

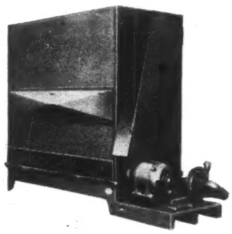
ARE MAKING MANY INSTALLATIONS IMPORTANT TO DEFENSE



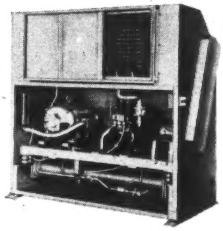
Water-cooled Condensing Units —through 40 tons

in

- Army, Navy, Air Force Projects,
- Industrial Processing,
- Research Laboratories,
- Commissaries,
- Storage Plants— Food, Biological, Chemical



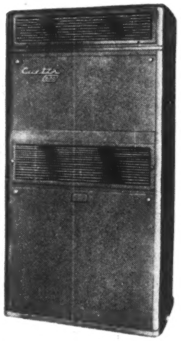
Evaporative Condensers, Cooling Towers and Air Handling Units to match



Central Type— 10-15 ton

The broad CURTIS line of Air Conditioning, Temperature and Humidity Control equipment enables CURTIS distributors to *quote* and *get* many of these installations.

With Condensing Units through 40 HP . . . Evaporative Condensers . . . Cooling Towers and Air Handling Units to match, CURTIS distributors can handle *more* jobs, make *greater* profits.



Package Type— 2-4-6-8 ton

Some Franchises are Open. Pin this coupon to letterhead and mail for complete information.

Curtis
REFRIGERATION
AIR CONDITIONING
COMMERCIAL

Curtis Refrigerating Machine Division
of Curtis Manufacturing Company
1950 Kienlen Avenue • St. Louis 20, Missouri

I am interested in exclusive Curtis Franchise. Send complete details.

Name____________________

Street____________________

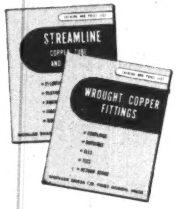
City____________ Zone____ State____

98 Years of Successful Manufacturing Experience is "Built-In" Curtis Equipment

Streamline®

SOLDER TYPE GATE VALVES

for dependable, long lasting service

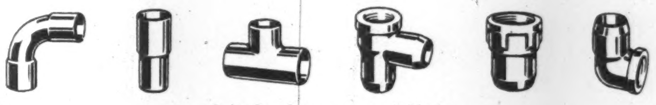


See your jobber for further information or write for catalogs S-351 and W-251 describing our complete line of STREAMLINE wrought copper and cast bronze fittings.

The new Streamline solder-type gate valve is built for durable operation in the 125# steam working pressure class of general service.

Its engineering design was perfected after many months of testing. Careful machining of seat and wedge disc gives positive shut-off with light pressure. Special lug design eliminates the possibility of installing disc backwards. And, non-rising stem allows installation in minimum amount of space.

The Streamline gate valve, which is furnished in a complete range of sizes from ½″ nominal through 2″ nominal, is an extremely rugged, seep-proof unit that will withstand the most severe usage and yet consistently give positive shut-off. Get the full facts today.



Streamline fittings are available in a complete range of standard sizes.

71

STREAMLINE PRODUCTS

MUELLER BRASS CO. PORT HURON 1, MICHIGAN

THE VALUE IN VULCAN

There's real value in Vulcan design.

Fin-tube radiation (heating unit and piping combined) is easiest to calculate, easiest to install (requires fewer fittings).

There's real value in Vulcan material.

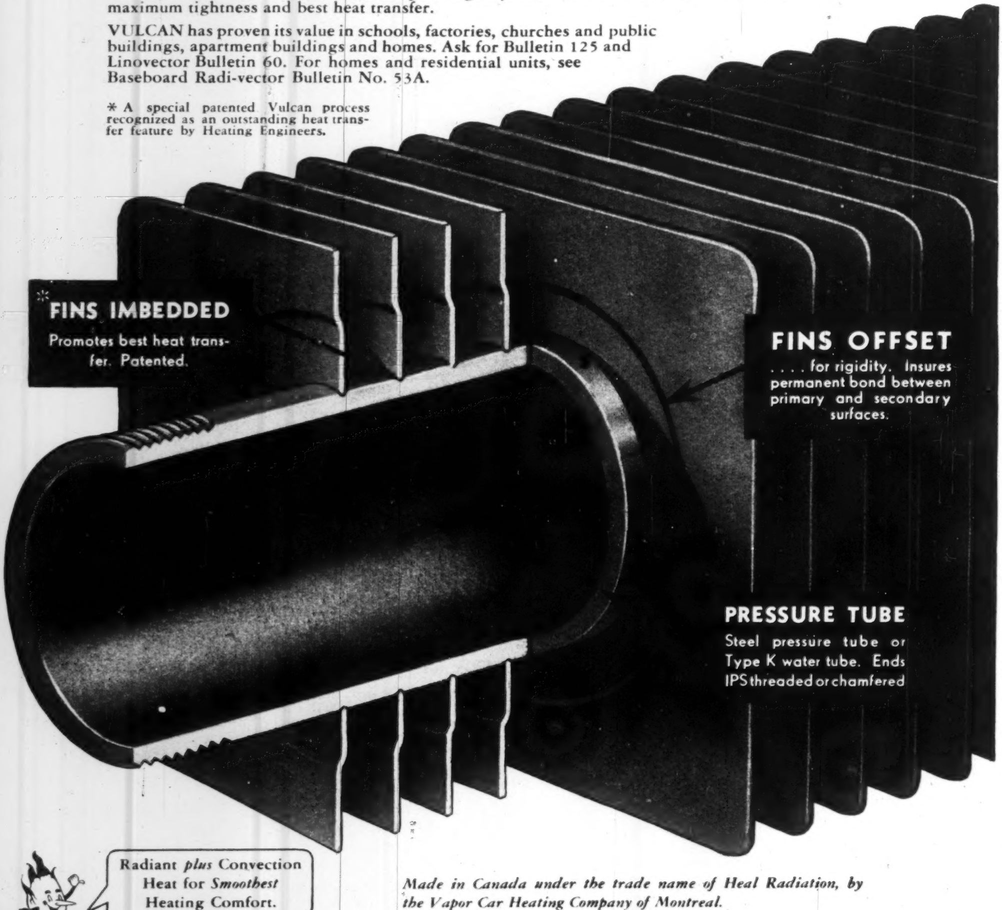
Vulcan steel radiation is fabricated from seamless steel pressure tube, ends threaded to Government Standards or chamfered for welding. Vulcan copper is fabricated from Type K Water Tube—aluminum or copper fins of highest quality.

There's real value in Vulcan construction.

Vulcan fins are uniform, offset for complete rigidity. Fins are also imbedded* in the tube for maximum tightness and best heat transfer.

VULCAN has proven its value in schools, factories, churches and public buildings, apartment buildings and homes. Ask for Bulletin 125 and Linovector Bulletin 60. For homes and residential units, see Baseboard Radi-vector Bulletin No. 53A.

* A special patented Vulcan process recognized as an outstanding heat transfer feature by Heating Engineers.



***FINS IMBEDDED**

Promotes best heat transfer. Patented.

FINS OFFSET

. . . . for rigidity. Insures permanent bond between primary and secondary surfaces.

PRESSURE TUBE

Steel pressure tube or Type K water tube. Ends IPS threaded or chamfered

Radiant *plus* Convection Heat for *Smoothest* Heating Comfort.

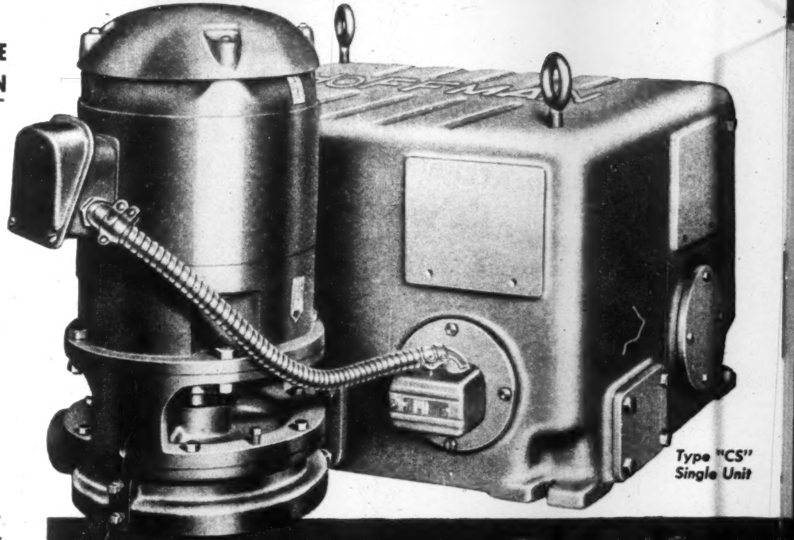
Made in Canada under the trade name of Heal Radiation, by the Vapor Car Heating Company of Montreal.

Over a Quarter Century a Leader in Fin-Tube Radiation . . .

The VULCAN RADIATOR COMPANY

16 FRANCIS AVENUE HARTFORD, CONNECTICUT

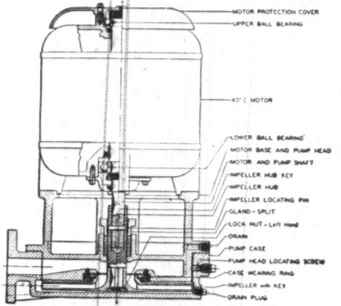
Announcing! HOFFMAN *New Improved* CLOSE-COUPLED CONDENSATION PUMPS

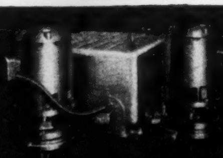


Type "CS" Single Unit

THESE FEATURES ASSURE YOU THE MOST MODERN PUMP AVAILABLE

1. Bronze fitted throughout.
2. Enclosed, precision balanced bronze impeller.
3. Stainless steel impeller hub.
4. Renewable bronze wearing ring.
5. Split bronze packing gland.
6. Drain plug for impeller casing.
7. Standard ball bearing motor, 40°C continuous duty, with ample overload capacity.
8. Heavy cast iron receiver.
9. Heavy duty float control, seamless copper float and brass rod.
10. Impeller has top suction inlet—eliminates air or vapor binding.
11. No piping between pump and receiver.
12. Float switch adjustable to various water levels.
13. Rigid motor support, very quiet.
14. Threaded outlet on pump cover to provide drainage and eliminate base with drip lip.


MOTOR PROTECTION COVER
UPPER BALL BEARING
40°C MOTOR
LOWER BALL BEARING
MOTOR BASE AND PUMP HEAD
MOTOR AND PUMP SHAFT
IMPELLER HUB KEY
IMPELLER HUB
IMPELLER LOCATING PIN
GLAND - SPLIT
LOCK NUT - Left Hand
DRAIN
PUMP CASE
PUMP HEAD LOCATING SCREW
CASE WEARING RING
IMPELLER with KEY
DRAIN PLUG



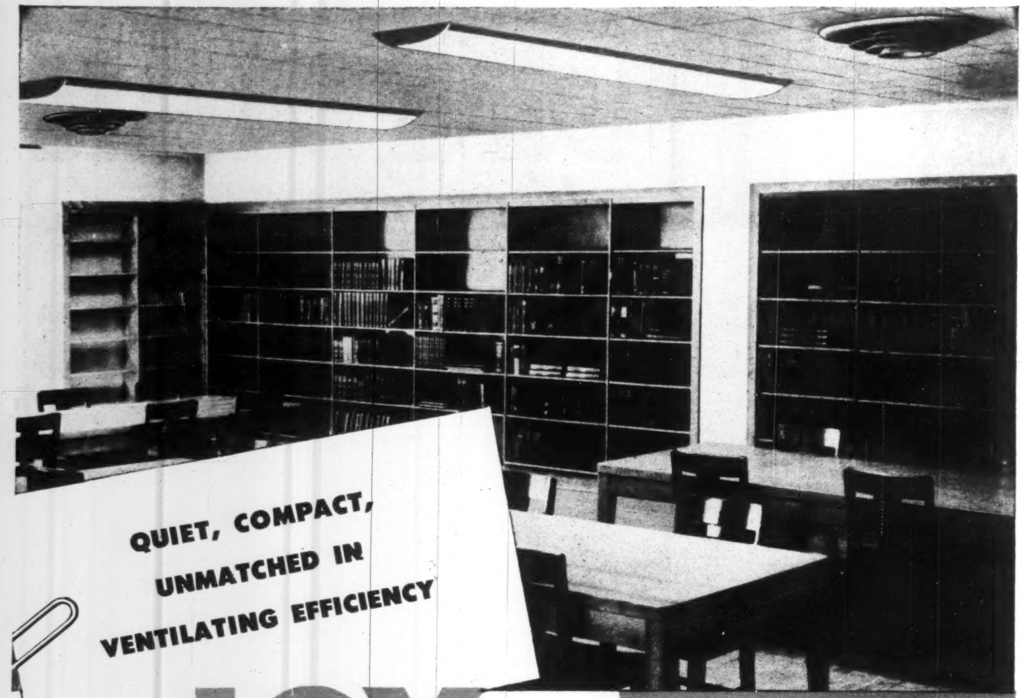
Hoffman, [illegible] pumps, [illegible] completely [illegible] Close-Coupled Condensation [illegible] single and duplex [illegible]

[illegible] compact [illegible] design features [illegible] They are [illegible] can be easily removed. All [illegible] Series "CS" and "CO" Pump capacities [illegible] EDR. Discharge pressures [illegible] All together, these pumps [illegible]

FOR SMALL SYSTEMS THE HOFFMAN [illegible]

HOFFMAN SPECIALTY CO., Inc. [illegible]

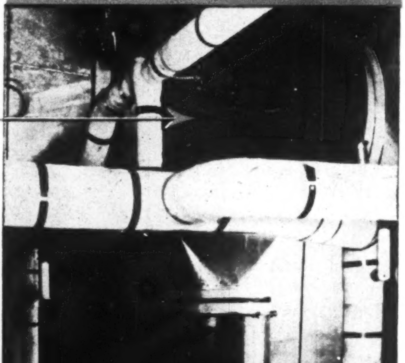
[illegible]



View in the Kansas Wesleyan Memorial Library, Salina, Kansas, ventilated with JOY Fans. Note ceiling louvers.

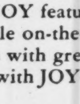
JOY AXIVANE® FANS

...BEST in Public Buildings



Wilson & Company, Engineers (Salina)—the consulting engineers—selected JOY Fans for this job. They mount right in the air duct, saving space and installation cost.

The compact, vaneaxial design of JOY AXIVANE Fans offers you important advantages of quiet, more efficient operation and savings on space requirements, installation costs, and power consumption. In addition, adjustable blades—a standard JOY feature—give you easy flexibility . . . you can make a simple on-the-job adjustment to meet new or changed conditions with greatest efficiency. ● For any ventilation job, check first with JOY—world's largest manufacturer of vaneaxial fans.



Write for Bulletin, or

Consult a Joy Engineer

W&D I 3520

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

A Statement by Anaconda on the Copper Situation

Many users of copper have vital decisions to make . . . usually in connection with the present defense-induced shortages of copper and aluminum. This statement is an effort to remove the smoke screen surrounding the copper picture . . . to wipe away the confusion caused by too much talk supported by too few facts.

Substitution poses problems – Industry has been urged to substitute aluminum and other materials for copper. In some instances this may be logical and practicable. In many others it is difficult, if not impossible. But – before making *any* long-term decisions that may cost a great deal of money in engineering, new plant facilities or rescheduling of production operations – one should know the facts about the future of copper.

New Anaconda projects – The first major increase in copper production will come from Anaconda when the Greater Butte Project and the new Sulphide Plant at Chuquicamata, Chile, begin operations this spring. By 1953, these two projects should raise present levels of copper production by about 95,000 tons yearly.

Toward the close of 1953, Anaconda's new Yerington project in Nevada is expected to start producing at an annual rate of 30,000 tons. By then, Anaconda will be adding to the present yearly copper supply at the rate of about 125,000 tons.

Other new projects – During 1954-55 still other new projects in the U. S. and friendly foreign countries will further augment the increasing copper supply. All told, it is estimated that by 1955, not less than 450,000 tons of copper could be produced annually – over and above present production levels.

Accordingly, in 1955-56, domestic production plus imports could bring the U. S. copper supply to 1,800,000 tons yearly. This would represent an increase of about 20% over present levels. Based on historical comparisons, and barring a large-scale shooting war, this amount of copper could support a Federal Reserve Board Index of Industrial Production of 270, an increase of 24% over the present, and 45% above the first half of 1950.

• • •

These are the 'things to come' in copper. On the basis of the facts there is no necessity for considering long-range substitution of other materials for the red metal.

52320A

ANACONDA
COPPER MINING COMPANY

The American Brass Company
Anaconda Wire & Cable Company
International Smelting and Refining Company
Andes Copper Mining Company
Chile Copper Company
Greene Cananea Copper Company

PRODUCERS OF: Copper, Zinc, Lead, Silver, Gold, Cadmium, Vanadium, Superphosphate, Manganese Ore, Ferromanganese.

MANUFACTURERS OF: Electrical Wires and Cables, Copper, Brass, Bronze and other Copper Alloys in such forms as Sheet, Plate, Tube, Pipe, Rod, Wire, Forgings, Stampings, Extrusions, Flexible Metal Hose and Tubing.

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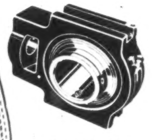
BALL BEARING UNITS

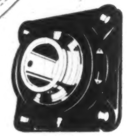
Self-Aligning

IN ANY DIRECTION WITHOUT SEAL DISTORTION

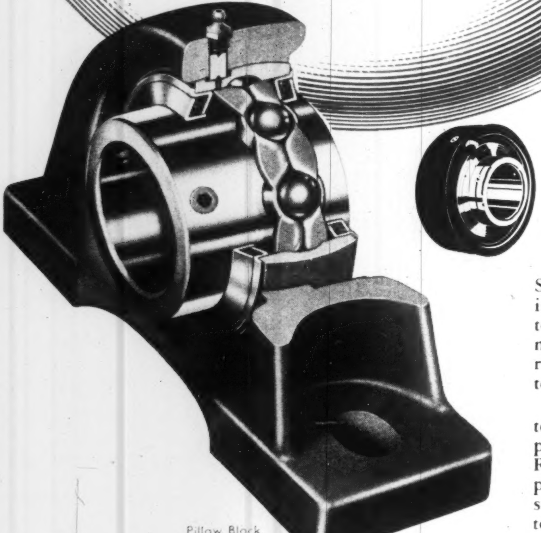


Take-Up Unit

Flange-Cartridge Unit



Flange Unit



Cartridge Unit

Pillow Block

SealMaster Ball Bearing Units take less time to install and maintain because they are designed to permit some misalignment. The outer race is machined on a radius and closely fitted into the radius ground housing. The bearing is thus free to move within its support.

What makes practical a misalignment of 2° to 4° in any direction *without capacity loss* is the patented perimeter dimple and its locking pin. Rotation of the outer race within the housing is prevented. The pre-lubricated SealMaster remains securely sealed—a very definite saving in maintenance.

SealMasters on machines in your plant are easy to *maintain*—are an extra sales feature on equipment you *design*—are something to look for on new machines you *purchase.*

For complete data on SealMaster bearings tell us to mail you Catalog 845.

SEALMASTER BEARINGS

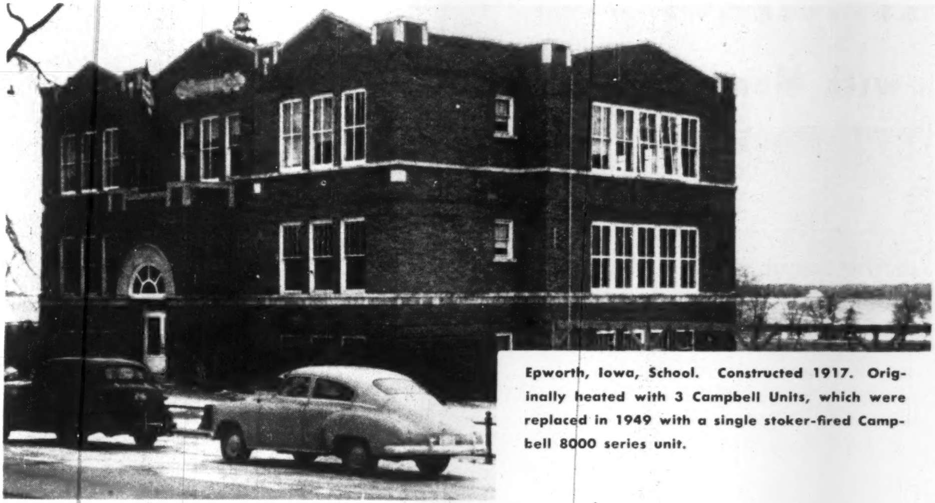
A DIVISION OF STEPHENS-ADAMSON MFG. COMPANY • 47 RIDGEWAY AVENUE, AURORA, ILLINOIS

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

WARM AIR HEATED...

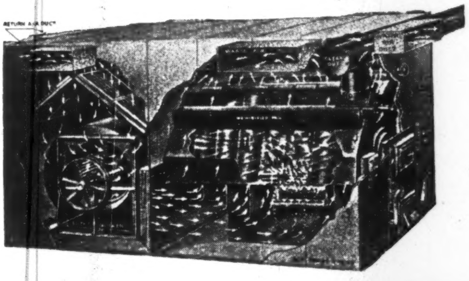
by Campbell

FOR 35 YEARS



Epworth, Iowa, School. Constructed 1917. Originally heated with 3 Campbell Units, which were replaced in 1949 with a single stoker-fired Campbell 8000 series unit.

For dependable, outstanding performance, specify Campbell 8000 Series Heaters for schools and other large multipleroom structures. Campbell Heaters make fullest use of the natural advantages of warm air heating; fast heat delivery, quick, positive control of temperature and ventilation, and EXCEPTIONAL FUEL ECONOMY. Available for all fuels in capacities up to 2,160,000 BTUs.



SPECIAL UNITS FOR DRYING & PROCESSING

We build direct oil and gas-fired units up to 14,000,000 BTUs.

CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

NEW

HEAT SAVING EFFICIENCY

with Mundet 85% Magnesia

Send for Complete New Catalog

MUNDET

"custom-molded" 85% MAGNESIA HEAT insulation

Engineering and Specification Data

Mundet Cork Corporation

Mundet district offices are conveniently located coast-to-coast.

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CHARLOTTE 3, N. C.
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CINCINNATI 2
427 West 4th Street
DALLAS 10
601 Second Ave.
DETROIT 21
14401 Prairie Avenue
HOUSTON 1
Commerce and Palmer Streets
INDIANAPOLIS 4
15 E. Washington St.
JACKSONVILLE 6, FLA.
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In Canada:
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

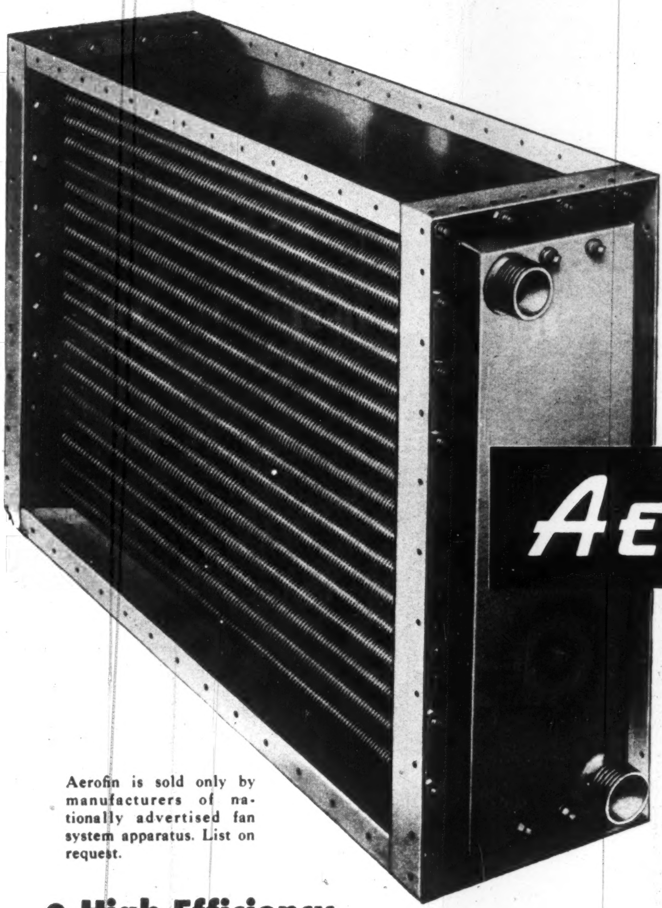
Now available in pipe covering and block insulation, Mundet Custom-Molded 85% Magnesia permits new heat-saving efficiency.

You benefit from these advantages when you use Mundet 85% Magnesia Insulation.

- ***Easier to Apply***
It cuts easily and cleanly, even without canvas support. No chipping, crumbling or "powdering." Blocks score cleanly.
- ***Lighter Weight***
Only 11 lbs. per cubic foot density. Even larger sizes and thicknesses are easy for one man to handle.
- ***Controlled Uniformity***
Precision manufacture on the latest type of equipment insures uniform standards.
- ***More Durable***
Greater "ductile strength" is built into the insulation. It does not "powder," settle or disintegrate even with heavy vibration. It withstands handling and may be removed and reapplied if necessary.
- ***Does not Shrink or Warp***
Steam or water leakage does not affect it. It does not shrink or warp even after soaking.
- ***Attractive Smooth Finish***
No unsightly, inefficient "bagging." Mundet 85% Magnesia insulation retains its neat appearance and effectiveness.
- ***Precision Pipe Fit***
No spaces are left for the escape of heat. The whole heated surface is snugly enclosed.

Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7113 Tonnelle Avenue, North Bergen, N. J.

INSULATION FOR HIGH AND LOW TEMPERATURE



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Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

- **High Efficiency**
- **Long Service Life**
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You are assured of high efficiency in heating or cooling — long service life — low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively* — offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research — and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

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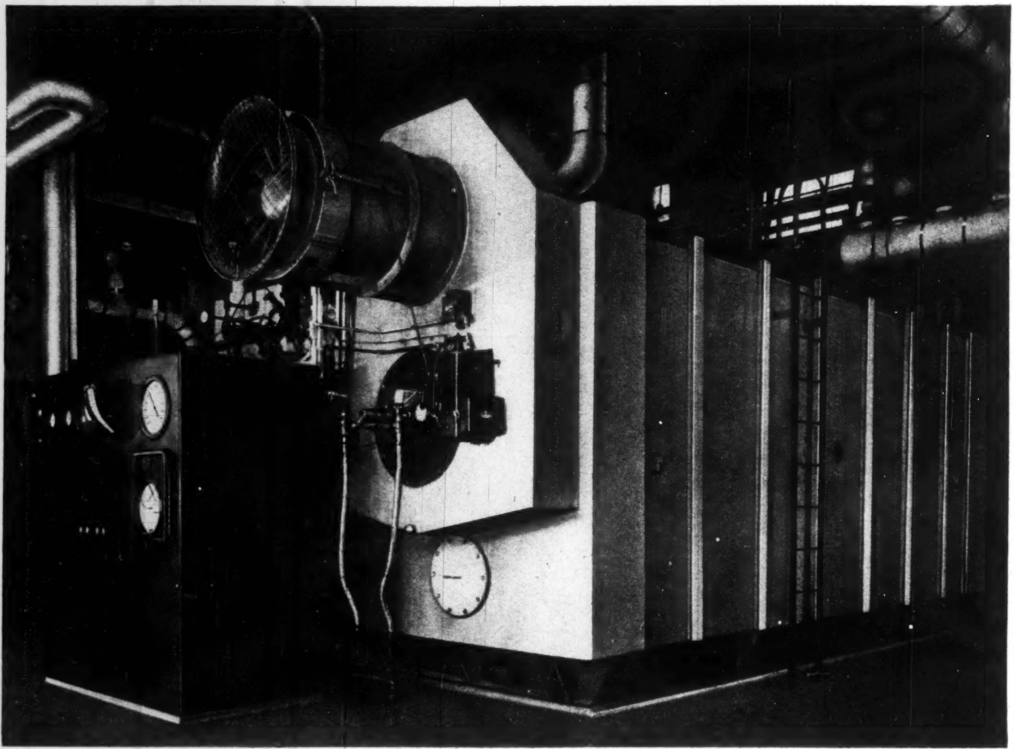


making FRIENDS fast

The B&W Integral-Furnace Boiler, Type FM

SHOP ASSEMBLED FOR SAVINGS

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

All the benefits of "packaged" steam are combined with the traditional economies and big boiler advantages of B&W's Integral-Furnace design in this compact, shop-assembled, ready-to-use unit. You can set it down wherever you want it, and set it up —ready to operate—in jig-time.

Already, well over 100 users in 24 broad industrial and commercial classifications in 29 states, two territories and 6 foreign countries have selected the B&W Integral-Furnace Boiler, Type FM, to produce a total 4,200,000 lb per hour of low-cost steam. Many of these users have placed repeat orders.

This popular self-contained unit is available for efficient heating and process steam-generation from 2900 to 28,000 lb per hr. at pressures to 250 psi. It's worth investigating.

Send for bulletin G-76 detailing advantages of this latest B&W creation in low-cost steam generation. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

BABCOCK & WILCOX

G-560

THE EDITOR'S PAGES

$15,751,131,000 FOR '51 CONSTRUCTION

TOTAL CONSTRUCTION contract awards in 1951 for the 37 states east of the Rockies amounted to $15,751,131,000 or 8 percent more than 1950's total, according to the F. W. Dodge Corp., construction news and marketing specialists.

Non-residential awards last year reached $6,822,513,000, or 31 percent more than the 1950 total. Residential contracts of $6,205,388,000 were 8 percent below the 1950 comparative figure.

Public and private works and utilities totalled $2,723,230,000, 6 percent higher than the previous year.

BUERKEL & CO. MARKS 75th ANNIVERSARY

BUERKEL & CO., INC., Boston, founded in 1877, is celebrating 75 years of progress, and has marked the occasion with an attractive booklet telling something of its achievements in heating, ventilating, air conditioning, industrial piping, power plants and plumbing.

John F. Buerkel was the founder of the company and Herbert A. Snow is its president.

In 1922, Buerkel & Co. designed and installed the complete heating and ventilating systems in the Employers Liability Assurance Corp. building, Boston. In 1939, Buerkel designed and installed the complete heating and air conditioning systems in the New England Mutual Life Insurance Co. building in the same city.

In the period between these two projects, the value of complete heating and air conditioning for a modern office building was clearly demonstrated, says the booklet, and air conditioning has become definitely established as an essential feature of a modern building. Use of welding to reduce the maintenance costs and prolong the life of piping systems is also mentioned.

Further changes in building construction cited in the booklet include "developments in radiant floor and ceiling heating; sidewalk, roof and street snow melting systems; electronic control of heating and cooling equipment; solar heat; and heat pumps."

"QUOTE"

"There is grave danger that private building activity will be put on a starvation diet which will lead to widespread unemployment unless the entire construction industry organizes to impress defense officials with the serious consequences of the continued cutbacks in materials allocations.

"Other industries, whose products cannot by any stretch of the imagination be regarded as more essential or more urgent than new housing and other construction, are receiving increased allotments of critical materials, while construction is receiving less and less of those materials each time a new order is written.

"The building industry does not ask that it be given materials needed for defense production. It does ask that it receive a fair share of the materials remaining after defense requirements have been met."—A. NAUGHTON LANE, President, The Producers' Council, Inc.

NAVY TO USE PLASTIC PIPE IN MINESWEEPERS

AS THE RESULT OF an eight-month sea test aboard a destroyer escort, the Navy plans to install plastic piping in several minesweepers now being built, the Defense Production Administration reports. Advantages are expected to be savings in scarce metals and reduced installation and maintenance costs in some cases.

The tests have indicated that for many purposes plastics outlast metal. Even in compartments where the air was very hot the plastic pipes did not corrode or burn.

Several pieces of plastic pipe were installed just above the boiler drum, where the air temperature reached 180 F. After eight months of service aboard the destroyer escort, this pipe was not affected.

Plastic pipe also does not corrode from salt water and is resistant to shock. Sections of plastic pipe carrying salt water under pressure were installed just aft of the forward guns. They remained good as new while nearby metal pipes had to be removed because they were damaged by the combination of corrosion and shock.

The chief engineer of the destroyer escort also reported that during a storm, in which the pipe was subjected to severe stress and vibration, the plastic pipe was not visibly damaged. Several metallic pipes, however, gave way.

Plastic pipe was installed in representative places throughout the destroyer escort for purposes of the test. The Norfolk Naval Shipyard did the installation work under guidance of the U. S. Naval Engineering Experiment Station at Annapolis. For example, plastic fire main piping 3/16 in. thick was put in locations where resistance to heat, shock, and average salt water conditions could be determined.

PRESERVATION OF IRREPLACEABLE DOCUMENTS

THE DECLARATION of Independence and the Constitution of the United States are precious and irreplaceable documents whose preservation for an indefinite number of centuries is vital. Even harmful effects that appear only slowly or to a slight extent become important. Hence the Library of Congress requested the National Bureau of Standards to determine the best means of preserving the sheepskin parchments on which these historical statements are inscribed. An important proviso in this assignment was that these revered documents should continue to be on display in the Shrine at the Library of Congress.

Gordon M. Kline, Chief of the NBS Organic and Fibrous Div., explains the preservation methods in a recent article in the American Society for Testing Materials Bulletin.

After consideration of the various factors which lead to the deterioration of the protein base of the parchments, it was decided to enclose the documents within sealed receptacles filled with helium, an inert gas. This protects the documents against chemically active gases such as oxygen and sulfur dioxide, insects and microorganisms, and contamination with dirt or corrosive substances.

Research conducted in the NBS Leather Section indicated that the appropriate relative humidity of the helium should be between 25 and 35 percent at room temperature. Too little moisture leads to brittleness and cracking of the parchment; large amounts of moisture produce damaging hydrolytic reactions and are conducive to the growth of bacteria that do not require air for reproduction. The desired humidity was achieved by passing the helium through distilled water maintained at a temperature of 4 to 6 C. Sheets of pure cellulose were made from cotton rags in the NBS experimental paper mill to back up the documents and to serve as a humidity reservoir to offset any changes in the water vapor content of the atmosphere in the enclosure resulting from temperature variation.

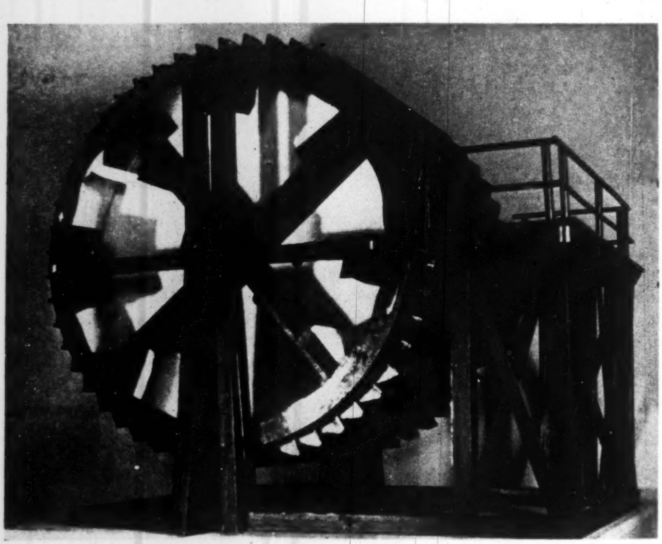
Double-glazed panels were used for the enclosures.

Further details regarding the studies at the National Bureau of Standards leading to this method for the preservation of documents will be found in NBS Circular 505 entitled *Preservation of the Declaration of Independence and the Constitution of the United States*, 1951, for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 15c.

LEONARDO DA VINCI WAS ONE OF US

THE COLLECTION of models constructed from the scientific drawings of Leonardo da Vinci, and acquired in 1951 by the International Business Machines Corp., gain special interest this year with the celebration of Leonardo's 500th birthday anniversary throughout the world. The models were made under the supervision of Dr. Roberto Guatelli, noted Leonardo scholar.

Famous the world over for his paintings of the *Mona Lisa* and *Last Supper*, it is only recently that Leonardo's achievements in anatomy, aerology and flight, mechanics, mathematics and optics as well as numerous other fields of thought and research, have been revealed in all their greatness. Five centuries ago, he conceived such inventions as the helicopter, machine gun, airplane and even the air conditioner, pioneering many engineering achievements now familiar to us.



THIS "AIR CONDITIONING unit" was for the boudoir of Beatrice d'Este, wife of Leonardo's patron, the Duke of Milan. The great wheel, a full story high, stood outside the palace wall and was turned by water power — assisted sometimes by slaves. Valves opened and closed automatically, drawing air into the drum, where it was washed and forced out through the hollow shaft and piped into the room. (Photo courtesy Collections of International Business Machines Corp.)

If you have requested a copy of the index for the 1951 issues of HPAC, it will be mailed to you as soon as it is available.

STANDARDS ASSOCIATION MEMBERSHIP GAINS

SIX TRADE ASSOCIATIONS and technical societies now represent the air conditioning and refrigeration industry on the roster of national organizations holding membership in the American Standards Association.

The ASA approved 113 American standards in 1951, bringing the total number of new and revised American standards in effect to 1181. Newly approved standards included *Recommended Practice for Mechanical Refrigeration Installations on Shipboard*, B59.1-1950 and *Method of Rating and Testing Refrigerant Expansion Valves*, B60.1-1951.

ASA membership increased by 12 trade associations and technical societies and 84 company members in 1951.

UNDERGROUND PROPANE TANK LEAK CAUSES FIRES

LEAKAGE FROM a new underground propane tank supplying fuel for heating a store was responsible for a series of fires and explosions recently, according to the findings of a crew which exhumed the tank.

It was found that the tank was provided with a tapped opening for a drain plug on its under side. The opening had not been closed by the insertion of a plug, according to the investigation, so that liquid propane began seeping through the ground as soon as the tank was filled.

Three small lateral sewers connected to the main sewer passed very close to the buried tank, so that the liquid propane and the propane vapor formed by its evaporation easily found its way into the conduit, and from there through other lateral sewers into various buildings in the area, where the fires and explosions occurred, according to J. R. Fellows.

COLD FEET...

Dampness, Tremendous Heat Loss, Peeling Paint, Timber Rot, are the Products of Usual Crawl Space Construction

Nature's Law: Heat flows to cold in any direction by Radiation and Conduction.

So warm walls, ceilings, furniture, people, even dust particles, transmit *downwards* invisible energy rays through the air to a cold floor where they are absorbed, turned into heat, and conducted down. Also, heat flows *down* by direct conduction through solids, wherever walls, furniture and people touch the colder floor.

How to prevent condensation and timber rot, conserve heat and create foot comfort, are explained by the National Housing Agency. Its "Technical Bulletin No. 38" reports numerous tests in which the National Bureau of Standards subjected multiple aluminum surfaces in crawl spaces to dampness from below, deliberate fogging, and tremendous temperature drops. To quote some of the findings:

DEWPOINT NEVER REACHED

"The temperature of these surfaces was observed to be above the dew point of the contacting air under all test conditions."

"With average outside air temperatures between 30.9 and 32.2 degrees F., the temperatures of the upper surface of the insulation remained above the dew point of the air to which it was exposed by 12.5 to 15.7 degrees F.," with only 2 layers having 4 aluminum surfaces, forming 3 reflective spaces.

"When the outside temperature dropped from 56.3°F. to 31.4°F. in six hours, the insulation temperatures remained above the dew point by 14.6 to 10.3°F. When the ambient temperature was dropped from 39.2°F. to 9.2°F. in 24 hours, the insulation temperatures remained above the dew point by 12.9 to 5.8°F.," with only one layer of insulation, two reflective surfaces and spaces.

CONDENSATION CANNOT OCCUR

"As a further indication of lack of condensation, the upper surface of the upper layer of insulation was deliberately fogged during several of the tests. Each time the surface of the insulation was so fogged, the condensed moisture disappeared within 5 to 10 minutes."

"The results indicate that condensation would not occur between the floor and the insulation or between the two layers of insulation during any probable winter conditions."

"Reflective insulation produces a marked rise in the temperatures of the floor surface."

ORDINARY INSULATIONS SPILL OUT

Vapor flows from areas of greater density to those of lesser. The lower its temperature, the less vapor can air retain in suspension.

Ordinary insulations, including asphalt paper covered ones (asphalt is not impervious to vapor, only to moisture), get soaking wet in crawl spaces, because of condensation on the fibres from ambient vapor, and vapor flow from the earth below and the building above. So they tear at the staples and elsewhere because of wetness and added weight, and spill their contents to the earth, unless a costly support is built underneath, in which case timber rot is fostered by the wet mass.

Multiple accordion aluminum sheets weigh less than 1 oz. per sq. ft., are impervious to vapor, are non-condensation-forming, do not absorb nor retain any moisture, need only staples for support. They bar heat flow by RADIATION with their 3% absorptive and 3% emissive surfaces. Practically no heat flows by CONDUCTION through their multiple air spaces for air is a poor conductor. There is no CONVECTION heat flow downwards.

NON-CONDENSATION FORMING INSULATION

One commercial form of multiple accordion aluminum, Infra Insulation Type 6, is pre-fabricated with three sheets of tough aluminum and two separating fibres to automatically form six reflective spaces, six fully reflective surfaces, as it is stapled in place, simply and speedily. Infra Type 4 provides 4 reflective spaces. For shallow structural spaces (less than 2") especially under floors, Type 4 Jr. is suggested.

For a more detailed discussion of the principles of heat and vapor flow and their practical application to the prevention of heat loss, discomfort and destructive condensation, consult "Technical Bulletin No. 38" and Alexander Schwartz's "Simplified Physics of Vapor and Thermal Insulation." Copies of either or both sent **FREE.**

INFRA THERMAL FACTORS, DOWNHEAT

Type 6	**C.044**	**R22.72**	**= 9" Dry rockwool**
Type 4	**C.065**	**R15.38**	**= 6" Dry rockwool**
Type 4 Jr.*	**C.097**	**R10.30**	**= 4⅛" Dry rockwool**

***In 1" space.**

INFRA INSULATION, INC.

525 Broadway, New York, N.Y.—WORTH 4-2241

INFRA INSULATION, INC., 525 Broadway, N. Y. C. Dept. H-3

☐ Please send FREE "Technical Bulletin No. 38. ☐ Send FREE "Simplified Physics of Vapor and Thermal Insulation," new revised edition. ☐ Send Prices of Infra Insulations. ☐ Send Sample.

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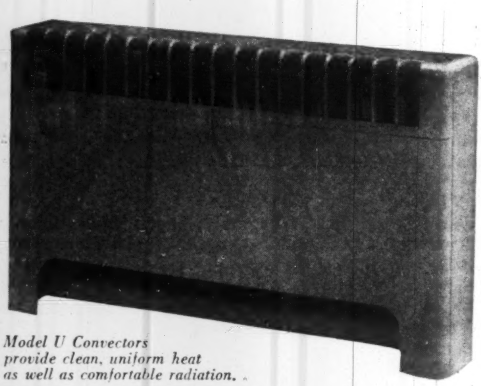
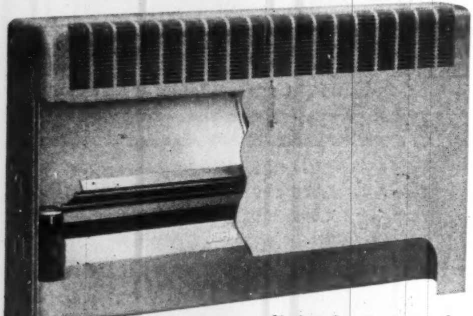
How many of these *advantages* do you get in the *convectors* YOU buy?



Model U Convectors provide clean, uniform heat as well as comfortable radiation.

You get all these in NESBITT Model U Convectors



Nesbitt Convectors are the delight of heating contractors because of their light weight and ease of installation.

Scientific design: an *engineered* product resulting from 40 years of Nesbitt *pionairing* in the comfort heating field. ☐

Superior construction: of heavier than customary furniture steel; sturdily reinforced; built up to a reputation, not down to a price. ☐

Artistic styling: conformable to the best décor; rounded edges; functional curved-top grille for added heating capacity. ☐

Pleasing finish: phosphated metal, hardcoated in a neutral prime gray that takes a color coat well, but does not require it. ☐

Universal application: to one or two-pipe hot water systems (forced or gravity), or to two-pipe steam systems. ☐

Optional placement: the one casing may be installed free-standing or semi-recessed, as desired, with front easily removable. ☐

Easy connection: with universal headers tapped for every practicable hookup without removal of element from casing. ☐

Stock sizes: modular lengths in two heights, offering 23 standard sizes—from wholesaler stock—for practically every requirement. ☐

Honest ratings: in generous conformance with Commercial Standard 140-47 and approved by the Convector Rating Committee. ☐

Individual packing: fully assembled in a durable corrugated carton for delivery to the job in mint condition. ☐

Dampers optional: in complete separate packages, with all attachments, for easy installation, originally or later. ☐

Competitive prices: with the savings of large-volume, production-line manufacture passed on to you. ☐

Reliable guarantee: against original defects in material or workmanship, for one year from date of shipment. ☐

Order Convectors *by name:* NESBITT

Sold exclusively through Plumbing and Heating Wholesalers

A product of JOHN J. NESBITT, INC., State Road and Rhawn Street, Philadelphia 36, Penna.

"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2

WHEN IS A DRAFT NOT A DRAFT?

I READ WITH interest the comments on What is a Draft? in the January HPAC.

In our operation of having to try to satisfy the human comfort requests of approximately 26,000 people, the word "draft" is most distasteful to us. The reason, of course, is because it often means something that we cannot do much about without taking the risk of upsetting the balance so that other occupants are uncomfortable, or requesting funds to make what ultimately turns out to be a major modification and expenditure.

One of our leading local consulting engineers described it very well, I thought, when he said: "I sometimes think that if we stay in business too long, we will not have much business, because the more we learn about our installations, the more it costs our clients when we design a system, in order to insure as near perfection as we know how to achieve."

Specifically, in our dictionary, the word "draft" means an objectionable air movement and is a function of velocity, temperature and location. There are times (depending upon season, ambient temperature) when the same (or even greater) air movement causes a comforting (rather than a discomforting) feeling; under such conditions, neither we nor our occupants refer to this as a "draft". —W. B. PRIDE, Mechanical Engineer, Plant Engineering Dept., Boeing Airplane Co.

HOW SHOULD FANS BE NOISE-RATED?

BEFORE REPLYING TO Mr. Currie's discussion on *Methods of Rating Noise from Fans*, in the February HPAC, a few corrections seem to me to be in order. Fig. 2 of the article under discussion indicates throb frequency in pulses per second as pictured in Fig. 1, not sound frequency in cycles per second. The sound frequency associated with Fig. 2 is that of the entire noise spectrum of the fan. Therefore, this precludes any comparison of Fig. 2 with the curves of Fletcher and Munson.

Incidentally, a 90 decibel, 25 cycle sound is not at the threshold of audibility as indicated by Mr. Currie but has a loudness level of 80 phons, which is equivalent in loudness (ear response) to an 80 decibel, 1000 cycle sound (see ASA Z24.2-1942, *American Standard for Noise Measurement*, or Fig. 1 of *Fan Noise Level — What Does It Mean?*, June 1951 HPAC). This has no bearing on the problem at hand but is simply a correction.

The "Q", "C", and "I" regions of Fig. 2 are relative only. Actually, all noises are annoying and "Q" is not taken to mean "quiet as the still of the night."

Sound level meters indicate the decibel level of the root mean square sound pressure and not the peak pressure, as stated by Mr. Currie (see ASA Z24-1-1951, *American Standard Acoustical Terminology*, or any good physics text). This pressure is given by the dotted line of Fig. 1. The ear, however, registers the instantaneous values.

The main issue has been clouded by frequent repetition and discussion of points not at issue. In order to clarify the overall picture, it would be well to summarize this series of discussions and restate clearly the points still at issue.

Points Not At Issue

The following are points of agreement and should be omitted from further discussion: (1) A strong test code is desirable, one which provides a fair comparison of fan noise ratings and accurately describes to the prospective customer the noise to be expected. (2) The human ear cannot be used as the measuring device in any rigid test code, because there is too great a variation among ears.

Another point to be dropped from further discussion is the elementary fact that the human ear in the final analysis is the basic criterion of all noise. Whatever system of noise ratings is adopted, the degree of success will depend entirely upon how closely the rating follows the actual response of the average human ear. There can be no argument on this score, it seems to me; after all, noise ratings were established for the ear — if there were no ears there would be no need for noise ratings. Regardless of measured decibel levels, people will ultimately decide just how noisy a fan really is.

Points Still At Issue

The sole remaining point of disagreement seems to be the one on noise throb — that is, whether or not it is of consequence in fans. The comparison with anvil noise as given in the first paragraph of page 89, December 1951 HPAC, is diagrammatically correct insofar as the illustration of throb is concerned. It is intended to show how a pulsating sound comes in "chunks" as contrasted to a steady sound. That propeller throb is often distinct and sharp is common knowledge to even the layman who observes an airplane and hears the throb of its propeller. The same sort of throb, to a lesser degree, is common in industrial air moving equipment. Such throb is not limited to two and three bladed propellers as mentioned by Mr. Currie but can be present with any number of blades. The throb frequency is equal to the number of blades multiplied by the revolutions per unit of time, and the strength of the pulse is dependent only on the tip speed, blade airfoil section and width, and the ratio of the air velocity to the tip speed. This is not merely a theoretical derivation; noise throb with multiblade impellers is rather common and has frequently been observed with 12 blade propellers of large diameters.

I have no criticism concerning the

accuracy of the sound power method of rating fans, so long as the microphone positions do not miss the "high spots" of localized sources of noise. Missing the high spots is also possible with more distant microphone positions (as with the present test code) but is less likely because sound tends to spread out in spherical waves.

However, the method of stating sound ratings in watts is open to criticism because it is not linear with the human ear response. A noise twice the sound power of another noise is not twice as loud but only 3.01 decibels louder. Conversely, a 100 decibel noise, which seems twice as loud as a 50 decibel noise to the average human ear, would have 100,000 times the sound power rating of a 50 decibel noise. This would require a mathematical manipulation each time one desired a clear picture of the noise to be expected.

In any case, sound intensity level can be converted into sound power just as sound power can be used to predict intensity level, on those rare occasions when required by fan purchasers.

Sound power cannot be "combined with the fundamental frequency of the fan since the number of blades used is also known", as stated by Mr. Currie. Fan noise is a heterogeneous mixture of many frequencies and not composed of a discreet fundamental frequency plus harmonics as is the case with most noises. The *basic* noise frequency is not necessarily the *throb* frequency, but is the *sound* frequency of the most important noise.

In conclusion, it should be understood that annoyance varies greatly from ear to ear and no method of rating noise will fit all. We can only hope to improve the present method, not perfect it. An immediate improvement could be adopted by recognizing throb in the rating. For example, a 70 decibel, two blade, 1800 rpm fan could be rated "70 db-I" (per Fig. 2 of the article under discussion), or "70 db-DP" (distinct pulse), or "70 db-60 p/s" (60 pulses per second). Of course, "noise band" ratings such as "Q", "C", and "I" would have the advantage of de-emphasizing the mistaken impression of high degree accuracy of ratings. —R. A. GERLITZ, Chief Engineer, Propellair Div., Robbins & Myers, Inc.

[*Note* — Mr. Gerlitz and Mr. Currie have expressed in helpful manner their views on methods of rating noise from fans, and their comments on the matter have appeared in several recent issues. The editors would welcome expressions from other readers who would like to "get into the act" and say something on the subject.]

"WET HEAT" AND "DRY HEAT" ARE MISLEADING

I AM VERY GLAD to comment on Samuel R. Lewis' criticisms — in the January HPAC — of the use of the terms "wet heat" and "dry heat". Who ever invented such terms evidently had plenty of misinformation. And the use of the terms continues to spread misinformation.

As a matter of fact, in either case the actual amount of moisture in the air remains constant, but the air becomes "thirsty" as its temperature is raised, so that air at 70 deg which has had its temperature raised from zero, still has the same amount of moisture in it but wants more. It will hold more; in fact, about eight times as much.

So, any kind of a heating system is going to create dry air unless there is some means of supplying humidity. The warm air system, which the users of these terms call "dry heat", is quite successful in meeting that problem.

I don't altogether agree with Mr. Lewis about the continuous operation of the blower unless conditions are favorable to it. I agree that in a school building, if there are two ducts going to each room distributing through the same grille, and having a mixing damper which determines the temperature of the air going into the room, it is a good system. But even on such a system, particularly if the heat comes from a furnace, there should still be the bonnet switch which would determine whether the fan runs or not, according to whether there is sufficient heat so that the fan will not blow objectionably cold air.

The real reason for the bonnet switch, however, is to see that the fan is turned on when it should be. Operating men sometimes forget.

We have not had good success using the outside-inside thermostat and have discontinued its use on our furnace fan systems. We have even taken it out of some buildings — the reason being that it kept the fire on in mild weather when it should not be, and overheated the building. We believe the fire should be controlled entirely by conditions inside the building, and if the thermostats are set at proper temperatures they will take care of the fluctuations in outside temperature.

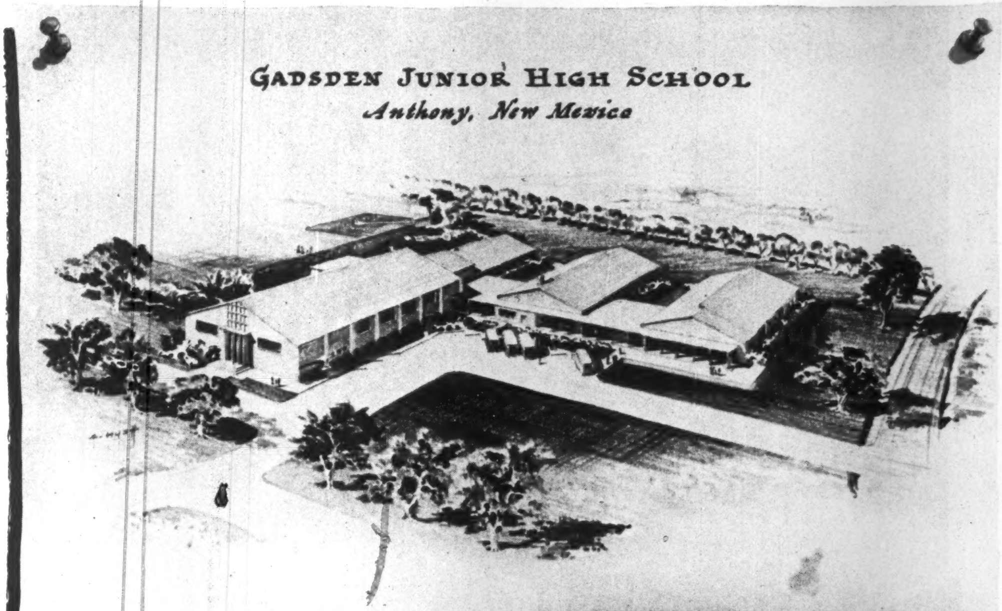
There is such a thing as getting too many controls on a system. Any controls more than necessary to provide comfort are a detriment to the job.—E. K. CAMPBELL, President, E. K. Campbell Co.

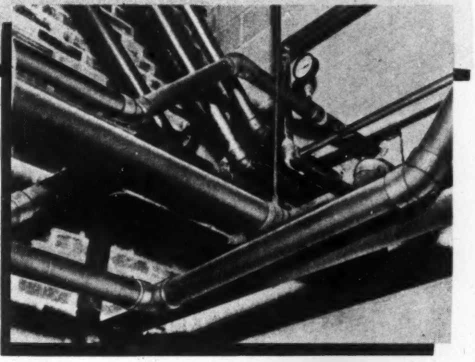
MORE THEORETICAL THAN PRACTICAL

THE COMMENTS BY Samuel R. Lewis, on his "Page" in the January HPAC, seem to me to be a good deal more theoretical than practical. It is true that the terms "wet heat" and "dry heat" are apt to be misleading if you consider the term descriptive of the condition of the air in the space that is being heated. The fact remains that the entire heating industry has used these terms for a generation or more, so I am expecting that they will continue as common language.

Mr. Lewis is critical because neither speaker discussed the efficiencies of combustion and heat transfer at the meeting to which he refers. Again, this is highly theoretical and of no practical importance to the owner. You can build a hot water boiler that is just as efficient as a direct fired warm air furnace. Likewise, you can build a warm air furnace that is just as efficient (in overall efficiency) as a hot water boiler.

Mr. Lewis suggests that a superior method of heating with warm air is to do so with constant air volume but to vary the air temperature. This is exactly the way that a well adjusted forced warm air job should work. The blower runs continuously, and at constant speed, whenever there is any need for heat. The burner will cycle on and off, as controlled by a very sensitive room thermostat, and the net result is that you actually modulate the temperature of the air that delivers continuously.—JOHN W. NORRIS, President, Lennox Furnace Co.





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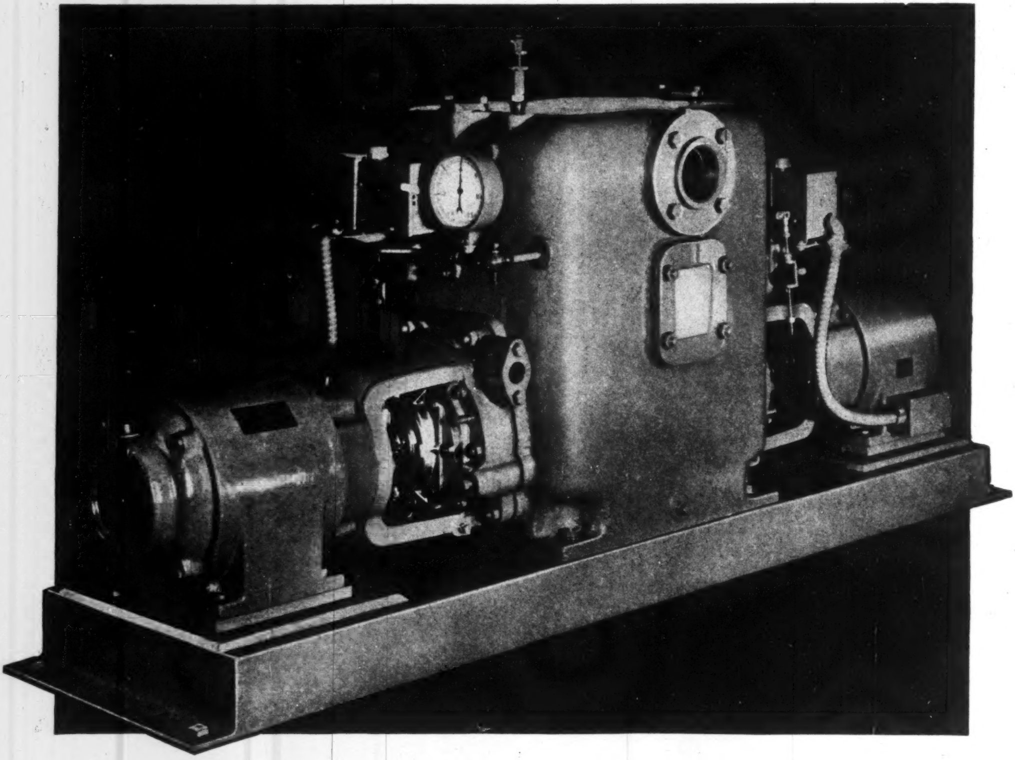

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How You Can Avoid Boiler Tube Corrosion

By H. F. Hinst
Chief Metallurgist
Tubular Products Div., Keystone Plant
The Babcock & Wilcox Co.

Study of the causes of boiler tube failures has revealed that the service life of tubes is dependent primarily on the environment, or the conditions of operation of the boiler. Proper operating and maintenance procedures should therefore be followed regularly to prolong tube life, reduce retubing, lower boiler outages, and cut costs.

CORROSION IS A MAJOR factor in shortening the useful life of boiler tubes. More tubes must be replaced in low pressure boilers because of corrosion than any other single cause. Boiler design, and the composition or quality of the tubes, are seldom primary considerations; replacement is usually necessary due to conditions of environment during service.

In large boilers, protection against fouling, scaling and corrosion is generally provided by adequate feedwater heaters and deaerators and effective feedwater treatment. Condensate is used in make-up; oxygen and carbon dioxide (the active corrodents) are reduced to low values, and water is kept to the proper degree of alkalinity.

This is not always the case with many small boilers—such as portable boilers, or those used in processing, for limited power generation, or low pressure boilers for heating. With this equipment, water conditioning facilities and technical control necessary for satisfactory and economical operation are often lacking. However, when the reasons why boiler tubes serve less than their expected life under such conditions are clearly understood, remedies helpful in prolonging tube life can be employed.

Rusting of railroad tracks after a rain and the rusting of fences and other steel structures are examples of atmospheric corrosion. This is only one of many different types of corrosion, but it has damaged metallic structures in the United States to the recently estimated amount of over $5 billion a year.

Atmospheric Corrosion

A piece of steel in the middle of a desert will not rust for a long time, but near the shores of a lake, ocean or stream, it will rust quite rapidly. Steel does not corrode appreciably in dry air but only in the presence of moisture. Likewise, steel will not corrode in clean, alkaline, freshly-boiled water, if air is kept away. However, corrosion of the steel takes place as soon as the water is exposed to air and has a chance to absorb oxygen.

Clean, neutral water alone will not affect steel, but corrosion will take place when oxygen is also present. Of course, clean, neutral water will dissolve minute amounts of steel, but in doing so a film of hydrogen forms on the steel and protects it unless removed.

Atmospheric corrosion may occur in boilers in isolated cases, but generally there are other factors that contribute to the corrosive attack—and to eventual tube failure, if precautionary measures are not followed.

Fire-Side Tube Corrosion

Corrosion on the fire side of boiler tubes is caused by moisture condensing from the atmosphere during periods of shut down, or from flue gases during operation. This type of corrosion is especially troublesome in boiler installations near bodies of water or where the atmosphere is otherwise humid, and is accelerated by the use of high-sulfur fuels. Sulfur gases may condense on tube surfaces when the boiler is operated at temperatures below 240 F, depending upon the kind of fuel and the methods of firing.

Some boilers—such as those in greenhouses—may operate at water temperatures of 140 to 150 F, and under such conditions the condensing gases form sulfurous and sulfuric acids, which attack the tubes and result in the type of corrosion shown in Fig. 1. If the percentage of sulfur in the fuel is high, this situation is worse. Even in the absence of sulfur compounds, corrosion may occur during shutdown periods because of high humidity in the air. When shutting down the boiler under such

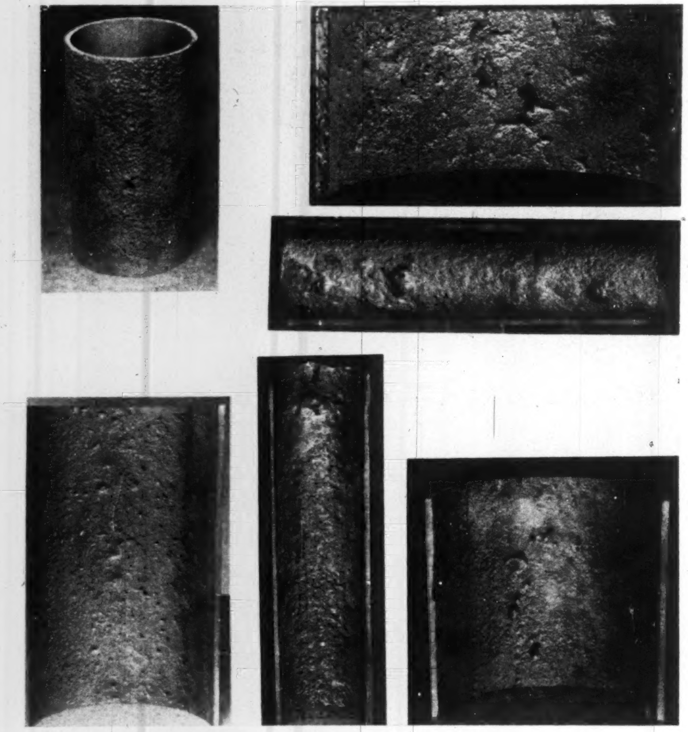


FIG. 1—FIRE-SIDE CORROSION of boiler tubes, after cleaning in inhibited acid. Tube at upper left from water tube boiler, others are from fire tube boilers

conditions, the fire-side tube surfaces should be brushed and flushed to remove the winter's accumulation of soot and other products of combustion; this should be followed by blowing air through to dry out these surfaces. Also, in extremely humid locations, the stack should be disconnected and a tray of unslaked lime placed in the ashpit to keep the fire side dry. This lime must be renewed whenever it becomes mushy, so the drying effectiveness will not be lost.

Leaky roofs above boilers and loose brickwork also cause corrosion of this type, both to boiler casings and to fire-side surfaces of water tube boilers.

Sulfur Content an Index of Corrosion

When flue gas is cooled below the dew point, the gas side of a boiler tube is subjected to corrosion, as indicated in Fig. 2. This is caused both by the moisture in the flue gas and the acids which result from the combination of condensed moisture and the sulfur compounds in the gas.

Minimum metal temperatures shown on Fig. 2 have been arrived at through practical experience, and there is little likelihood that corrosion will occur above these temperatures. They are shown as functions of the percentage of sulfur in the fuel for various types of firing, since the dew point of the flue gas rises in proportion to its content of sulfur oxides. The curves cannot be interpreted as indicating an exact relationship, since moisture in the fuel and other conditions are part of the corrosion problem. It is believed, however, that these other factors approximate an average for the fuels normally used, leaving the sulfur content a fair index of the corrosion probability.

The curves on the chart are based upon the experience of many boiler operators with a limited number of different grades of fuel. They represent the dividing line between those jobs which have given no serious trouble, or where no major replacement of parts on account of external corrosion has been required for a period of over five years, as compared with those jobs where such replacements have been necessary in less than five years (and in some cases in even less than one year.)

Leakage of water, considerable periods of low or banked operation, change of fuel source, cleanliness of the heating surfaces, and other factors will, of course, affect the life of the equipment and interpretation of the curves.

Pitting Corrosion

Pitting is probably the most destructive form of corrosion that affects the water side of boiler tubes. It is rather easily recognized by the presence of randomly-scattered pits. Frequently, only a few pits are present and most of the surface is unattacked; in other cases, the pits cover most of the surface, and as a further extreme, the pits all run together and the corrosion takes the form of uniform attack. The frequency of the pits is determined to a large extent by the degree of acidity or alkalinity of the water.

Acidity and alkalinity are expressed by chemists in terms of a scale of pH values (hydrogen-iron concentration) on which a strongly acid solution (strong muriatic or sulfuric acid) is rated as 1, and a strongly alkaline (concentrated caustic soda) solution is rated as 14. A neutral water has a pH value of 7. The charts in Fig. 4 show the relationship between the corrosion of steel and the condition of boiler water. As indicated, slightly acid and slightly alkaline water conditions (pH 5 to pH 9.4) are especially conducive to the formation of pits.

Dissolved Oxygen Affects Rate

The rate of corrosive attack is increased by dissolved oxygen in the boiler water. Dissolved oxygen corrosion works in three general ways: (1) air bubble pitting, (2) scab pitting, and (3) soft-scab pitting. The latter occurs in boiler drums, superheater tube surfaces, steam lines and other surfaces where the metal is not submerged during idle periods. The first two named are of principal interest here.

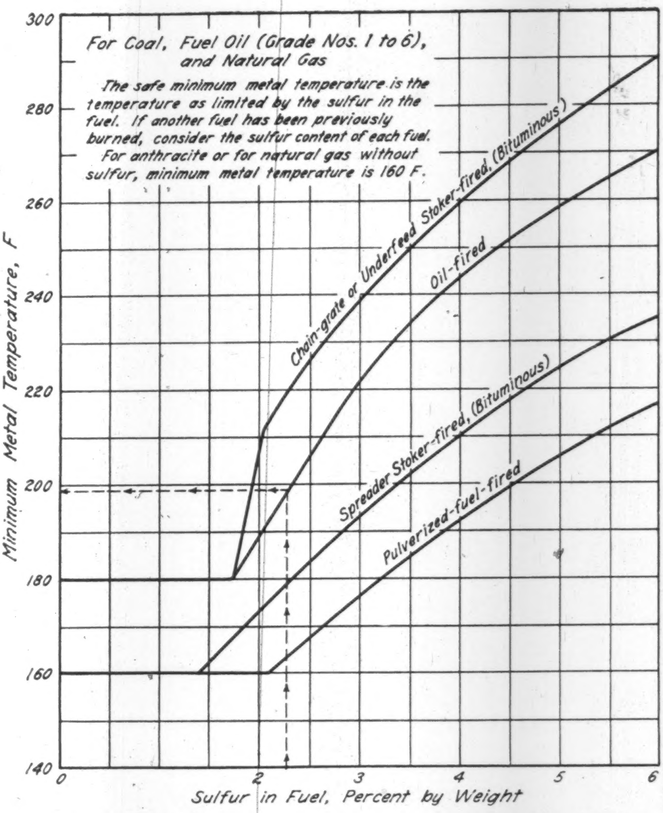


FIG. 2—FUEL SULFUR CONTENT is an index of corrosion of fire side of tubes, as condensation occurs when flue gas is cooled below dew point. Minimum temperatures shown were arrived at from experience

Air bubble pitting is caused by the formation of air bubbles on boiler metal surfaces under stagnant conditions. Surface waters are generally saturated with dissolved oxygen because of their exposure to the atmosphere. Oxygen may be present in varying amounts, depending on the temperature of the water (as shown in Fig. 5, which illustrates that oxygen solubility decreases with increase in temperature.) Well waters usually contain less dissolved oxygen than surface waters, and in deep well supplies, dissolved oxygen may be absent—although dissolved carbon dioxide which is also corrosive to steel, may be present.

When a boiler is filled with oxygen saturated water, small increases and fluctuations in water temperature tend to throw out the dissolved air as small bubbles, which readily attach themselves to any convenient surface. This can be demonstrated by filling a clear bottle with cold tap water and allowing it to stand for a few days. The bubbles will be quite profuse on the sides of the bottle.

When air bubbles attach themselves to a steel surface, the steel immediately surrounding the air bubble starts to rust because the environment between two closely adjacent areas is different; at one point is an air bubble containing 20 percent oxygen and next to that point, the steel is in contact with water containing much less oxygen. Such conditions promote the formation of electrochemical cells, which permit small electric currents to leave the steel where it is covered by water, and reenter the steel where it is covered by moist air. The rust is drawn over the bubble by capillary action and the small pocket of air becomes isolated from the rest of the water. Gradually, the steel under the bubble rusts the same as does a piece of steel in damp air. As it rusts, it removes the oxygen in the air inside the bubble, and eventually no oxygen is left. The corrosion then starts to eat its way into the tube at that spot. Cases are known in which 30 percent penetration of tube walls has taken place in one stagnant period of two weeks.

Why New Tubes Go Wrong

Sometimes a set of new tubes installed in a boiler has been found to last less than a year, whereas the former tubes lasted five to ten years. Obviously, something has changed. Often the tubes are blamed for the failure, when actually there have been changes associated with the operation and maintenance of the boiler. A different method of starting up may have been used. Circumstances may have been such that the boiler was immediately fired when the old set of tubes was put in, while the new set may have remained in the fresh water for some time and air bubble pitting may have started, leading to the eventual failure of the tubes. The temperature of the fill-up water may have been different, and therefore more air may have been present in the new installation. The composition of the fill-up water may have changed; a thin scale may have been laid down at the beginning of the life of the old tubes, which served as a protection. Piping and electrical lines may have been disconnected and reconnected. Small air or steam leaks around pipe joints and valves may have let air into the new set-up. Air vents may have become plugged due to jarring of the piping. In short, any number of things may have happened and caused the failure.

A large number of boiler tube failures take place in the fall when starting up for winter operation. These are due to both the air bubble pitting previously mentioned, and to oxygen sucked into the system through packing, etc.

It is possible to eliminate the effect of these mechanisms during such stagnant periods by proper treatment, such as adding sodium chromate at the rate of 1 lb per 50 gal or ½ lb of caustic soda per 100 gal of boiler water. Either of these chemicals should be added to fresh water in the

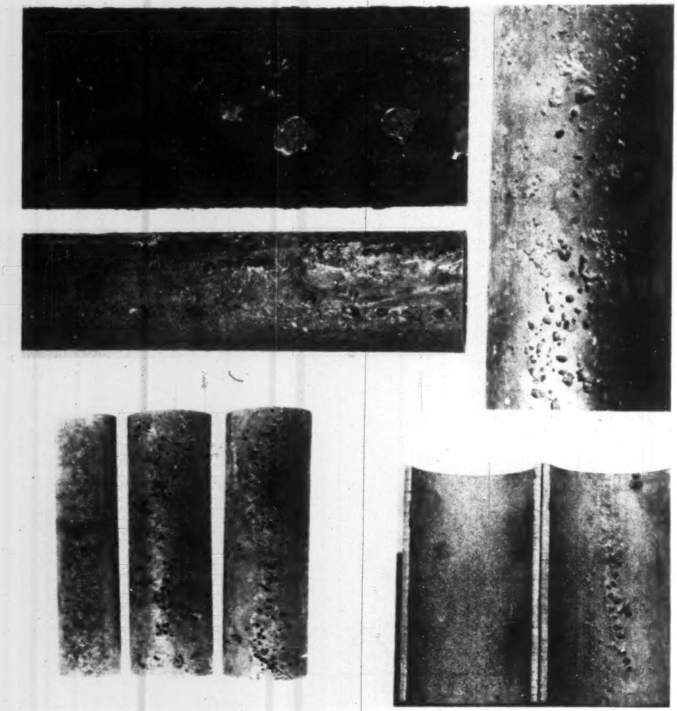


FIG. 3—PITTING DUE TO DISSOLVED OXYGEN. Lower right, water tube; others, fire tubes

spring before the summer lay-up. When the boiler is to be used, these chemicals should be left in the boiler water to protect the metal surfaces.

Even when a boiler is drained, and flushed clean after a shutdown, serious air bubble corrosion will occur if the boiler is filled with fresh water and allowed to stand for an indefinite time. This happens because the unit is filled with water through the regular feed line, which is generally near the top, and the water cascades down through the unit—dissolving oxygen up to the limit of solubility, and then entrapping even more mechanically. The proper procedure after cleaning a boiler is to fire it long enough and hard enough to take some steam from the unit, and deaerate the water in the boiler. It is far better, when shutting down, to leave the deaerated dirty water in the boiler than to drain and refill without subsequent firing.

Under good operating conditions boiler water must be free of oxygen and sufficiently alkaline. The oxygen may be removed by heating the feedwater to the boiling point with waste steam and venting off the air, or by means of chemicals such as sodium sulfite, ferrous sulfate and others, which unite chemically with the oxygen and remove it. Sodium sulfite is usually added to remove the last traces of oxygen even when a feedwater heater is used, and since in all cases an excess is to be maintained in the boiler water, it is a good solution to the problem. Relatively simple tests are available and can be used to maintain satisfactory control. Quite often, sodium sulfite is used effectively without a feedwater heating device.

Pay Attention To Packings

It is necessary to pay close attention to pump and valve packings in circulating steam and water systems to reduce the amount of make-up water required and to prevent continuous access of air. In the absence of such additions of air, the oxygen initially present in a closed system, and that introduced with small amounts of make-up water, will be consumed by a relatively slight amount of corrosion.

There is good reason to believe that scab pitting proceeds under operating conditions at points where penetration from air bubble corrosion has started, especially if no attempt is made to inhibit the corrosion characteristics of the water with chemical treatment. It is possible, however, to virtually eliminate pitting at operating temperatures by maintaining the boiler water above the theoretical pH of 9.4. A minimum value of 11.0 is considered good practice.

Maintaining proper alkalinity is relatively easy providing the proper chemicals are added in controlled amounts, and simple tests are made regularly.

Water-Line Corrosion

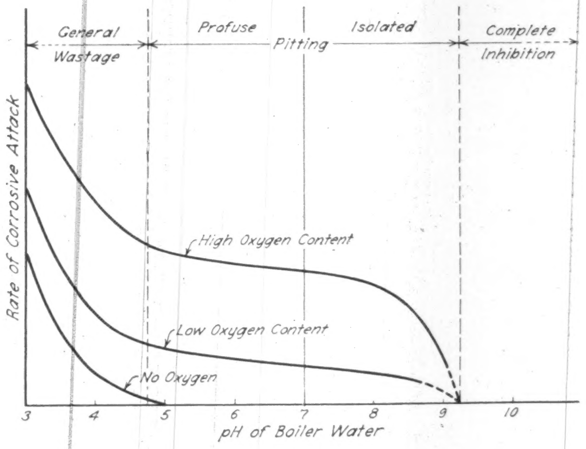
Water-line corrosion in vertical fire tube boilers is usually also due to an excess of oxygen in the boiler water, although in areas of very bad water conditions, the water may actually be acid. In either case the tubes fail by thinning, which is most pronounced at or slightly below the water line. As in the case of the air bubbling pitting, the corrosion is attributed to differences between the oxygen concentration at the water line and the concentration in the water below the water line. Examples of this type of corrosion are shown in Fig. 6. Sometimes excessively hard waters cause a scale to deposit on the tube and shield the tube below the water line from oxygen, thus causing corrosion at the water line by the same mechanism as that of air bubbling pitting.

Water-line corrosion may be avoided by making certain that boiler water is sufficiently alkaline, free of oxygen and chemically treated.

Concentration-Cell Corrosion

Concentration-cell corrosion is often associated with crevices, scale, surface deposits and other conditions, where the water in contact with the metal is stagnant.

Here, electrical currents are set in motion between the tube or boiler metal and the different concentrations of boiler water. Under a layer of either mill scale or scale deposited



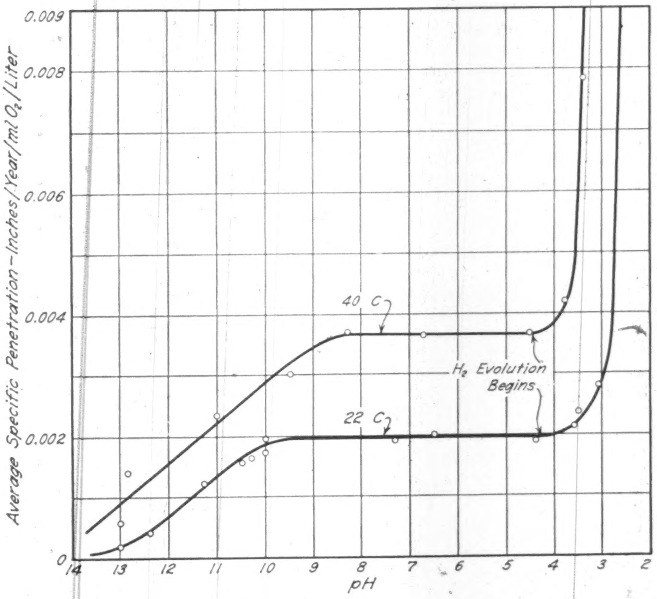


FIG. 4—RELATION BETWEEN corrosion of steel and condition of boiler water. [W. Whitman, R. Russell and V. Altieri, Ind. Eng. Chem., 16, 665 (1924)]

from hard waters, the motion of the water past the tube surface is held up, and, because of the steaming temperature, is concentrated. A difference in electromotive force (potential) exists between the steel in contact with the concentrated boiler water and the steel in contact with the regular boiler water. Current flows, and as it passes from the steel to the water, the steel is anodically dissolved with it. As the steel dissolves, the hole or pit gets progressively deeper, thus providing a better stagnating space, resulting in acceleration of the process and subsequent failure of the tubing due to perforation by pitting. Oxygen as well as the boiler water salts can help promote this action.

This type of corrosion can be eliminated by preventing scale formation through proper water treatment. Equipment design is also important.

Uniform Attack and General Corrosion

This can be readily recognized by a uniform thinning of tubing; and in most cases of this nature, products of corrosion will be absent. The dissolving of metals in acid is an example of the action which takes place. Corrosion of this type is not too common in boilers and is easily recognized. If it is suspected, a water analysis will probably disclose the answer. Low pH—denoting acidity—may be due to the presence of actual acid in the feedwater, the presence of large amounts of magnesium chloride, or to the presence of fatty acids from lubricants. Acids may come from polluted streams, and in some cases where well water is used, seepage from coal mines may be the source of the trouble. If the water is very acid, damage to feedwater piping may also occur.

The condition can be corrected by the addition of alkali (in the form of caustic soda) in sufficient amounts to maintain a minimum pH of 11.0 in the boiler water.

Galvanic Corrosion

When two dissimilar metals are in contact with each other and exposed to a corrosive liquid or conductive solution, a potential is set up between the two metals and an electric current flows. By means of the galvanic series, it is possible to predict what will happen when two different metals are in contact. Briefly, this practical electrochemical series is as follows.

+ Magnesium
Zinc
Aluminum
Steel or Iron
Lead
Nickel
Brass
Copper
Bronze
Silver
Graphite
Gold
— Platinum

This series shows that when two dissimilar metals are in contact, the one higher or more electropositive in the series will corrode in preference to the other, and the distance they are apart in the series denotes the extent of the galvanic attack

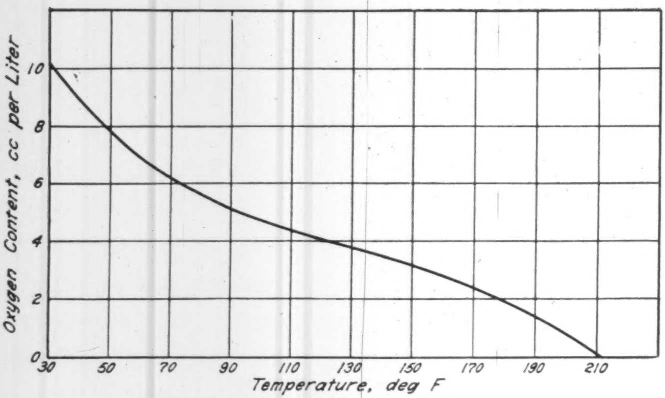


FIG. 5—SOLUBILITY of oxygen in water

(other factors being equal). Thus, if copper tubing is connected to steel pipe or tubing, the steel will corrode rather rapidly. On the other hand, if steel is connected to aluminum, the aluminum will waste away.

Cast iron baffles, which contain free graphite particles in the iron, in contact with steel boiler tubes, may promote corrosion of the boiler tubes in this way. This condition is usually recognized by pitting in the immediate vicinity of the contact area between the two metals. Occasionally tube corrosion takes place in a circumferential groove below one of these baffles because the steel is worn away by soot and ash particles impinging on the surface at high velocities.

In a limited number of instances, the galvanic property of metals can be used to advantage by mounting a more corrodible metal so that it will be corroded itself in preference to the steel. Such "sacrificial anodes" should only be used after careful investigation as to the best location, etc., since their protection is limited to a small, immediately surrounding area. This method has been used in preventing corrosion in hot water tanks and in protecting pipe lines, and has been tried in boilers—although in marine work, where this method was common some years ago, it has been practically discarded due to the impossibility of maintaining good electrical contact between the two metals.

The solution to this problem lies in the elimination of bi-metal construction, and in the possible use of sacrificial materials.

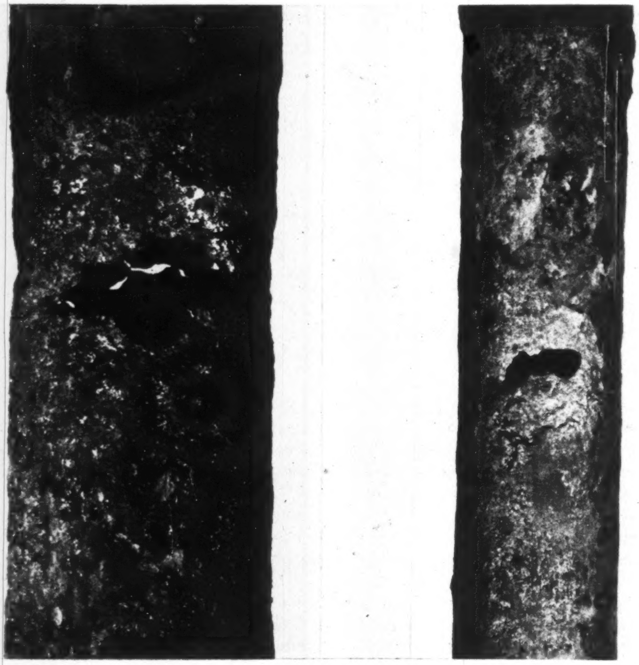
In rare instances, electrolysis from induced electrical currents has been found to be the cause of boiler tube corrosion, but authorities agree that it should not be considered as a cause of any single problem until all other conditions are corrected and the failures still persist. High tension lines running parallel with the boiler tubes, and nearby telephone ground connections, have been determined to be, in a few cases, the cause of corrosion.

Erosion-Corrosion (Cavitation)

Erosion-corrosion (cavitation) is due to the mechanical wearing away of metals by the flow of a liquid past the surface, coupled with the normal corrosion constantly taking place in solutions. Most of the commonly used metals depend on a protective film of oxide, or some other type of surface film or scale. If the fluid is moving at a sufficient velocity, and especially if it contains any suspended matter, it will wear away this protective film, expose a fresh surface, and repeat the process until failure occurs.

Erosion is most marked at pumps, valves, orifices, pipe lines (particularly at elbows and tees), and near the ends of boiler tubes where the water makes a sudden change in direction. Proper design, and in some cases substitution of material, should eliminate this condition, which is not particularly prevalent in small boilers. This phenomenon is not

FIG. 6—SEVERE WATER-LINE CORROSION (from fire tube boilers of the vertical type)



General Rules for Avoiding Corrosion

Water conditions play a most important part in the failure of boiler tubes. Experience over many years has verified the fact that oxygen dissolved in the feedwater probably causes more trouble to users of small boilers than does any other one condition.

Here are some general rules to help small boiler operators avoid serious tube corrosion problems, and obtain longer tube life with fewer unscheduled shutdowns and more economical maintenance.

Out-of-Service Factors

1) Boil out the boiler with an alkaline cleaner after installing new tubes to remove oil or other coatings from the tube surfaces. These protective coatings are commonly applied to new tubes to prevent rusting during storage and transit, and will cause corrosion if left on the tubes during operation of the boiler.

2) Bring a steam boiler to a good steam output as soon as it is filled after draining to deaerate the water. Heat the water in a hot water boiler to 180 F for the same reason. A temperature of 180 F will not remove all the air, but the majority will be driven off.

3) Add sodium chromate or caustic soda to the water in the quantities recommended.

4) In greenhouses or in damp locations, put a tray of unslaked lime in the ashpit to absorb moisture, and close the boiler. Inspect this lime occasionally and renew when it becomes mushy.

In-Service Factors

1) Keep all boiler fittings tight to keep air out.

2) Add sodium chromate or caustic soda to the water in the quantities recommended.

3) Preferably use a fuel with low sulfur content, to avoid the corrosive action of sulfur gases.

4) Brush and flush and dry out the insides of fire tubes as often as possible to remove soot and other products of combustion, and prevent the accumulation of moisture and condensed sulfur gases.

5) Use sodium sulfite regularly in the boiler feedwater to remove dissolved oxygen.

6) A suitable feedwater heater or deaerator is also recommended to reduce the oxygen content of the boiler feedwater.

7) Prevent water leakage and do not periodically drain water out of the system. These add to the necessity for the constant addition of make-up water, result in loss and dilution of the treatment, and introduce air into the system.

commonly encountered in boiler tubes in natural circulation boilers.

Stress Corrosion; Dezincification

Cold working of metals through operations such as flaring tube ends or punching rivet holes has been a condition indicated as promoting the progress of corrosion. The resulting corrosion is not too common in small boilers, but is included here to give an overall picture.

Boiler designs sometimes prohibit free expansion, in which case tubes might be subject to alternating stresses due to temperature fluctuations. A tube suffering from this type of corrosion while stressed will occasionally exhibit circumferential notches in the stressed area, but corrosive water is necessary for this to occur. If severe and prolonged, the condition can lead to abrupt fracture of the tube at the most heavily stressed area, which is usually adjacent to the header, tube sheet or drum.

Dezincification implies removal of zinc or other metals from alloys through a leaching out process. The actual mechanism may be more complex than this statement indicates, but for our purpose here it is sufficient, since actually it is a controversial subject. It occurs of course only with zinc-containing alloys such as brass, and is more commonly found in condenser equipment where such alloys are used, rather than in boilers.

CHANGE HIGH TEMPERATURE PIPE SPECIFICATIONS

REVISIONS HAVE BEEN approved in eight important piping materials specifications for high temperature service that were included in the part 1, 1951 supplement to the American Society for Testing Materials book of standards. In addition to changes approved at the ASTM annual meeting, the subcommittee responsible in committee A-1 on steel reached agreement late in the year on some important changes that could not be included in the 1951 supplement. While the modifications are not of a major nature, the consumers and producers concerned with the materials covered in these widely used specifications feel they are extremely significant.

Separate copies of the specifications in question will be struck off, and they will also be included in their latest form in the 1952 compilation of specifications for steel piping materials.

The specifications in which additional revisions are to appear are:

Seamless Alloy Steel Pipe for High Temperature Service (A 158-51 T)
Seamless Carbon Molybdenum Alloy Steel Pipe for High Temperature Service (A 206-51 T)
Seamless Chromium-Molybdenum Alloy Steel Pipe for Service at High Temperatures (A 280-51 T)
Seamless 1 Percent Chromium, 0.5 Percent Molybdenum Alloy Steel Pipe for Service at High Temperatures (A 315-51 T)
Seamless Carbon Steel Pipe for High Temperature Service (A 106-51 T)
Electric Fusion Welded Steel Pipe for High Temperature and High Pressure Service (A 155-51)
Factory Made Wrought Carbon and Alloy Steel Welding Fittings (A 234-51 T)
Seamless Ferritic Alloy Steel Pipe for High Temperature Service (A 335-51 T)

(In addition to these specifications, a change in the hydrostatic test pressure requirements of pipe specification A-53 is being approved in committee A-1 providing for the elimination of the holding time of 5 seconds for butt welded pipe. This requirement applicable to seamless, lap welded and electric welded material should not have been included in the 1951 version of A-53, and its deletion, now recommended, will provide relief to many butt weld mills.)

GIVE A PINT OF BLOOD TODAY FOR THE MEN IN KOREA

NEW CAFETERIA at Lewis Flight Propulsion Laboratory has convectors under windows to care for 90 percent of the wall and window losses, winter ventilation air supplied at constant temperature, and summer air conditioning

Cafeteria Installation Features.....

a) Elimination of drafts around windows. b) Elimination of cooking odors from dining room and corridors. c) Adequate dishwasher exhaust. d) Equipment room ventilation. e) Minimized grease deposit in kitchen exhaust system.

By George G. Reed, Mechanical Engineer
Lewis Flight Propulsion Laboratory

AFTER EXTENSIVE STUDY, it was decided that the following characteristics were to be included in the plans for the new cafeteria in the one-story east wing of the utilities building at the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics, Cleveland:

a) Elimination of drafts from around windows, due to the high exhaust rate usually found in such areas.

b) Elimination of cooking odors from dining room and corridors.

c) Adequate exhaust for the dishwasher.

d) Ventilation of the equipment room.

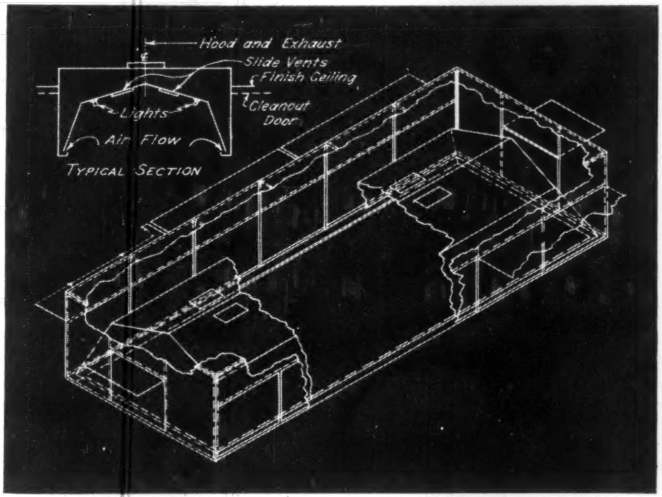
e) Minimized deposit of grease in the kitchen exhaust system.

It was decided to provide enough heat, with convectors under the windows, to compensate for 90 percent of the window and wall heat losses. The difficulty of returning steam condensate in a one-story building was a factor which resulted in the use of hot water for heating, with a converter and a circulating pump.

The controls on the hot water system are simple, and consist of a room thermostat stopping and starting the circulating pump and manual adjustment of the hot water temperature. The ventilation air in winter is supplied at a constant temperature of about 75 F, and any fluctuation in the heating load is compensated for by the hot water convectors.

Experience has further demonstrated that if the heating and cooling loads have been correctly calculated and if the heating requirements — particularly the air distribution — are correctly engineered, the cooling will "take care of itself."

The cafeteria has an area 80 by 175 ft and a maximum seating capacity of 400. The east half of the space is occupied by tables. Next to this area is the private dining room on the north side, the serving area on the south side, and the dishwashing room between them. The



KITCHEN EXHAUST HOOD has several original features. Dishwasher hood is the same in design but is smaller

west end of the space is occupied by the kitchen and storage rooms. The one-story wing of the utilities building in which the cafeteria is located has three sides exposed.

Eight changes of conditioned air (50 percent outside air) are supplied to the cafeteria each hour. The 50 percent excess air, which amounts to 5000 cfm, is drawn through the serving area and into the kitchen by the kitchen hood. An additional 7000 cfm of outside air, tempered in winter, is supplied to the kitchen to provide one air change per minute in the kitchen area and sufficient movement of air to make the working conditions comfortable. The movement of air is from the dining room into the kitchen.

Dishwasher and Kitchen Hoods

The dishwashing room opens directly into the kitchen area at one end and has chutes opening into the dining area at the other end through which the trays of dirty dishes are passed. Air is therefore available to the dishwashing room from the kitchen area and from the dining room.

The dishwasher hood is 6 in. wider on each side and 2 ft longer at each end than is the dishwashing machine. The dishwasher hood is the same in design but smaller than the kitchen hood shown in the accompanying sketch. Since most of the steam escapes from the ends of the dishwasher, it is important that the hood extend well beyond the ends. Air should also be exhausted from the ceiling to take care of the large amount of steam and vapor from the rinsed dishes in the racks. A minimum velocity of 50 fpm through the slot around the periphery of the hood and through the adjustable openings in the inner lining of the hood is required. Experience indicates that the fan motor should be 25 percent oversized and a split motor pulley used.

The kitchen hood — using the same air velocities, flexibility of volume and a two-speed motor — has a number of features which are believed to be original. Air which enters through the slot or openings expands and cools, depositing the grease on the inside of the hood. This grease and condensate collect in the trough at the bottom of the hood and can then be wiped out. In the dishwasher hood, the condensate is drained into the sink. Doors in the sides and ends of the hood permit removal of any deposits that fail to collect in the trough.

The total air exhausted is 12,000 cfm — 5000 cfm of conditioned air from the dining room, and 7000 cfm from the kitchen ventilating unit. Supply and return ducts are installed above the ceiling and the ceiling supply outlets are adjustable as to volume and throw.

The heating and air conditioning equipment is in an interior room and comprises the 40 hp compressor, fan and coil units, evaporative condenser, converter and domestic hot water heater. This room is ventilated by the evaporative condenser, which draws air directly from the room. Air enters the room through an opening in the roof.

The engineering offices are also in the utilities building and there is thus excellent opportunity to observe the functioning of the air conditioning and heating system. The cafeteria has been in operation during a winter and a summer season and the installation has proved very adequate.

The Smith & Oby Co. was the air conditioning contractor.

HOW TO RE-UNITE SEPARATED MERCURY

THE SEPARATION OF the mercury in a thermometer or a thermostat casing leaves most of us feeling helpless.

But before you take the time and trouble to send it back to the factory, why not try one or all three of these tricks? They're usually effective in re-uniting the mercury, says Robert Soroka, of the Minneapolis-Honeywell Regulator Co.

First, tap the case or thermometer in the palm of your hand, bulb down. If this doesn't work, try centrifugal force by attaching a stout string to the thermometer and swinging it in a circle around your head. Finally, there is the refrigeration technique, which involves placing the thermometer or thermostat casing in the freezing compartment of a refrigerator where the cold will draw the liquid down into the bulb.

These three tricks are most helpful where the mercury is merely separated near the top of the tube. If, however, there is the problem of an air bubble the refrigeration technique is usually the right method.

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Power Plant Piping

By Hugh Welshman, Jr.
Manager, Industrial Piping Div.
Grinnell Co., Inc.

Careful consideration should be given the design, manufacture, fabrication, installation and operation of modern piping systems. Present piping developments add to the necessity for proper engineering interpretation, specialized facilities, rigid inspection and control, and skilled shop and field supervision. The advantages of prefabricating power piping assemblies are considered this month

BASIC PROBLEMS involved in the design of a power piping system include (1) selection of pipe sizes to allow reasonable velocities and friction losses; (2) strength of parts to provide flexibility within allowable stress limits; (3) material selection to provide stability under the service temperatures and pressures for the life of the plant; and (4) selection of hangers and supports to prevent additive stresses and the shifting of pipe weight loads to connecting equipment.

Code requirements for piping and the determination of pipe sizes were discussed in the December issue. In January, determination of pipe wall thicknesses, expansion and stresses, piping materials, and cold springing of piping systems were considered, and the February installment discussed welding and fabricating details, preheating and stress relieving, quality control of welded joints, and pipe hangers and supports. Figs. 1 through 25 were presented with these first three parts of this article.

Plant Facilities for Prefabrication

A prefabricated piping system assures accurate assembly and speed and economy in erection.

To produce the quality of shop prefabrication at the site requires a duplication of all the complex, heavy equipment used in the up-to-date prefabricating plant. In the majority of cases, location facilities are not adaptable for such equipment. Even when facilities are available, the expense of the equipment and its erection are high. Further, with the proper field setup, it is usually still not possible to obtain the high quality of precision work that is assured by prefabrication handled by skilled workmen constantly employed on this work and under ideal working conditions.

The old axiom "a workman is no better than his tools" applies with full meaning to the art of quality prefabrication of piping systems. The piping fabricator, no matter how competent, depends not only on a full supply of adequate tools — but also on modern, highly specialized equipment peculiar to this type of work and with no counterpart in other industries. Many of these standard and special tools required for piping fabrication are extremely large and heavy; they likewise require service connections principally for electricity, gas and compressed air. Thus, the continual moving of these tools for field operations — from both the practical and economic standpoints — is far from feasible.

In the fabricator's shops, all this precision equipment is not only installed upon permanent, vibration-free foundations — but is located at proper stations for logical sequence of the fabricating operations. Fast cranes of large and small capacity are available for handling pipe, materials and completed assemblies. These tools embody all the improvements that materially facilitate the necessary operations, increase the accuracy of the work and decrease the time consumed.

Many specific operations are necessary in the prefabrication of piping. Some of these require engineering judgment, others shop facilities and equipment of a specialized character, and still others good management and skill in planning.

Extensive Research on Welding

The technique of welding the newer alloys particularly suitable for prefabricated systems has necessitated extensive research by the metallurgical and welding staffs. This study has succeeded in developing new welding methods and electrode materials. The results have been incorporated, under constant supervision, in shop practices. The exclusive welding techniques developed have become standard procedures.

The fabricator realizes the importance of furnishing his welders with a full complement of the necessary equipment for work positioning. Shops are equipped with the most advanced types of turntables, jigs, adjustable fixtures and positioners. (Fig. 26).

Many of the alloys developed for high pressure, high temperature services and for special corrosion resistant applications are susceptible to loss of their valuable properties at certain temperature levels and within certain temperature ranges. In order to retain these properties during fabrication, radiant type bending furnaces with accurately controlled temperatures and even distribution of heat are essential. Only furnaces equipped for the development, maintenance and control of the temperature of the piping material through definite heating and cooling cycles are capable of retaining and safeguarding the metallurgical properties which dictate the material choice. To assure constant control, these furnaces are instrumented for both temperature control and cycle recording.

Special Equipment for Machining Operations

The cumbersome shapes, large dimensions and heavy weights of prefabricated components require special equipment for performing machining operations on the various sections. Fig. 27 shows equipment that will handle a wide variety of precision machining operations. These operations include producing V or U bevels on pipe ends in preparation for welding, counterboring and taper boring, refacing flanges after fabrication, machining special finishes on flange faces and preparing pipe for nozzle welds.

This extensive equipment assures that the piping components will comply with dimensional specifications and that finishes will be correct.

Continual Inspection an Integral Part

Continual inspection is an integral part of the fabricator's program. Constant checking of material, procedures and dimensions assures that each individual component, each section assembly, and the complete systems will meet fully all the specifications of both the engineer's plans and recognized codes.

The progressive fabricator's policy of scientific investigation and rigid control results in the use of the most recent developments in materials and methods. Their laboratories handle problems pertaining to all phases of metallurgy. They are equipped for chemical analysis, for photomicrography and for physical testing from subzero to greatly elevated temperatures. Whenever possible, test conditions are made to approximate those in actual service.

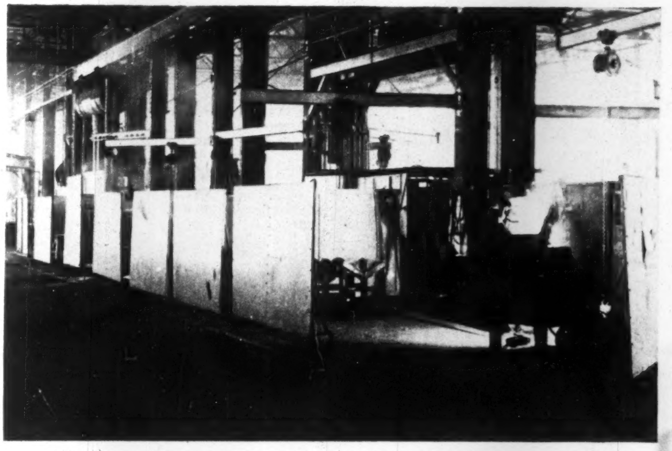


FIG. 26 — THE WELDING ROW in a piping prefabricating plant, showing some of the necessary equipment

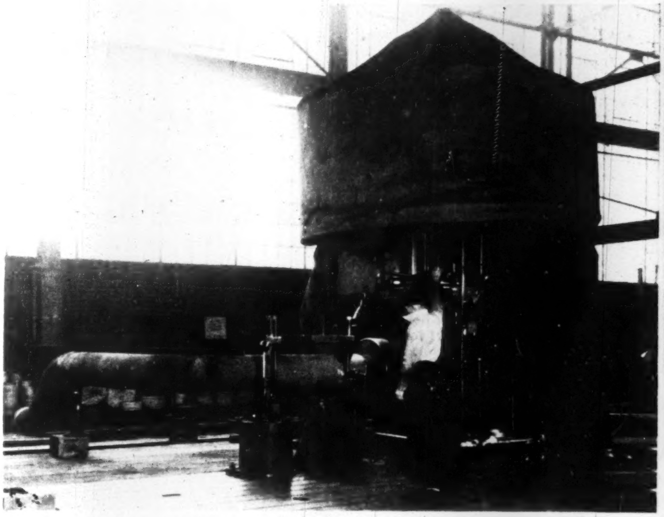


FIG 27 — HORIZONTAL BORING and milling machine in prefabricating plant performs many precision operations

[NOTE — This manuscript was presented as a lecture at the Extension School of the University of California. Much of the material is from the Grinnell Co. textbook *Piping Design and Engineering,* published and copyright 1951].

[*Concluded*]

MILES MEMORIAL METHODIST church is an example of how different floor coverings may be used with radiant heating. In the auditorium, asphalt tile covers the concrete slab, while the elevated floor at the chancel is of wood. Elsewhere, floors are of concrete and ceramic tile. Coils under the floor of this auditorium are ¾ in. wrought iron pipe set on 30 in. centers. In the entry off the auditorium, where heat loss is naturally greater, the pipes are larger (1½ in.) and closer together (24 in.)

Mr. Smith Goes To Norfolk

(A Study in Church Radiant Heating)

If the church we attend is a criterion, heating is the principal physical problem in such a building. A group of articles on the various methods of heating churches is planned, leading off with this "field trip" to Norfolk, Va., where there are a number of radiant jobs. Our trip is "conducted by" W. J. Binder, Manager, Engineering Service Dept., A. M. Byers Co.

Let us suppose that a heating engineer — we'll call him Smith — has an assignment to do a church building. One of the things he would have to decide before he went too far would be how to heat it. And one of the types of systems he would have to consider would be radiant heating.

Mr. Smith — if he were the energetic researcher he ought to be — would by now have done a lot of delving into the considerable literature that has been developed on radiant heating since it first came to the American public's notice some 15 or 20 years ago. And if he really wanted to see church radiant heating operate at first hand, he could study it thoroughly and instructively in one trip — to a city in the not-too-deep South.

Norfolk, Va., has an average January temperature of 41.6 F. This compares with 40.5 for Seattle, or 39.4 for Portland, Ore. It is not exactly "snow belt temperature," but neither is it as balmy as Miami's 67.7 or New Orleans' 54.8.

What would be most important to Smith is the fact that, in the past few years, radiant heating has been incorporated in several church structures in the Norfolk area, and in others which were under construction last year.

As a case study, these buildings offer enough variety to answer almost any question that Smith might have on the installation, operation and performance of radiant heating in churches.

Trinity Lutheran Is Typical

Typical of them is Trinity Lutheran church. It is an ell-shaped building, with each leg of the ell approximately 100 ft long. One leg contains the church proper, consisting of sanctuary, chancel, choir stalls, nave and narthex. The other leg is divided lengthwise; on one side is a hall, with a raised platform, which can be closed off as a meeting room; on the other side, there is a study, classroom, kitchen and parlor.

Wrought iron pipe is laid under the floor in both wings. In the church wing, except for the chancel, all the piping was formed in grids. Elsewhere, several types of coil shapes were employed. In this one church alone, Smith could find most of the conventional piping patterns used in radiant heating.

One of the things he would want to investigate is the cost of the heating installation. Trinity Lutheran church cost $50,000 to build. Of this, $4000 was spent on the heating system. How much of a buy the congregation got for its money is indicated in these words from an engineer's letter, written in December 1945, a few months after the church's dedication:

"On Sunday I attended the church service. The church was full except for the balcony. Before the service began I checked the temperature in the church with my own thermometer and found it 65 deg with 36 deg outside. This was very comfortable in spite of the fact that the entrance doors were left wide open until the service began. You could stand in the narthex right in front of the open doors and not feel the cold outside (a break for the minister who stands at the doorway after the service to greet his congregation).

"At a meeting of the vestry, they all expressed extreme pleasure with the heating and one man stated that on one Sunday the thermostat had been set for 68 deg and they found it too warm and had to open the windows. They anticipate lowering the temperature to 63 deg next service.

"They have been turning up the thermostat late Saturday night but believe that early Sunday morning will work out O.K. The Sunday school room is kept at 65 deg during the daytime and turned down at night. Both the thermostats had a low setting of only 60 deg and they are to be changed for thermostats having a low of 50 deg."

The first time the system was used on a Sunday, the sudden influx of people raised the temperature to an uncomfortable level. This, of course, could happen with any system of heating. The problem was solved by anticipating the increase and setting the thermostat 5 to 8 deg lower.

If Smith still had any doubts about the practicability of this particular system, he could ask the pastor of the church, Rev. Paul A. Plawin, who might show him a copy of a letter he wrote in 1946 to a fellow pastor in Pennsylvania, in which he said:

"Our church and parish hall are new structures, and we have no comparative figures upon which to judge economy in operation. Our parish hall was heated from Sunday to Sunday without letup, 24 hours a day, and the church itself was heated 1½ days per week. Altogether we paid out $240 for oil at 7.05c a gallon, and we had about 500 gallons left in the tank at the end of the season. So our heating bill was roughly $200 and we expect it to be less next season, because we are weatherstripping the windows on the north side. We are perfectly satisfied with the heating. In fact, we are delighted with it and sing its praises to the sky."

Miles Memorial Methodist Has 30-Odd Rooms

A short trip to the resort section of Norfolk, known as Ocean View, would take Mr. Smith to the Miles Memorial Methodist church, which has 30-odd rooms served by a radiant heating system that is divided into eight zones. Electronic controls permit separate heating for each zone.

A study of the way these zones are split up may serve as a guide to efficient heating practice on the basis of use:

First Floor

Zone 1 — Nursery, cradle roll, social hall, kitchen, storage room.
Zone 2 — Recreation room, two clubrooms.
Zone 3 — Chapel, entry.
Zone 4 — Auditorium, entry, narthex, pastor's room, two choir rooms, flower room.
Zone 5 — Pastor's study, two offices.
Zone 6 — Four classrooms.

Second Floor

Zone 7 — Five classrooms.
Zone 8 — Three classrooms, young people's department, junior department, tower room, balcony.

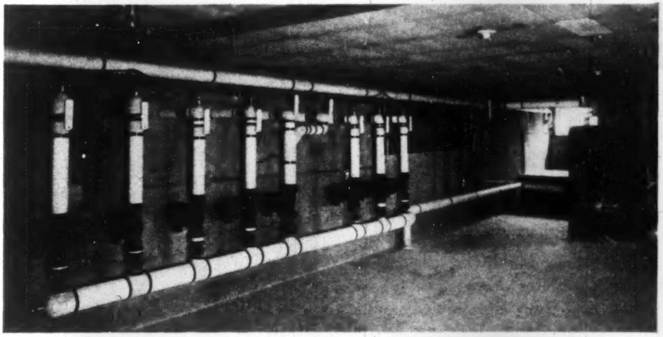
This arrangement permits use of the chapel, which has its own outside door, without heating other areas (zone 3). It allows the pursuit of classroom activities — which are extensive — by the operation of only three zones. For social and recreational functions, two zones (1 and 2) suffice.

The church also serves as an example of how different floor coverings can be employed over the heating slab to suit different needs. Asphalt tile is used in the auditorium, for instance, while the elevated floor at the chancel is made of wood. In the recreation room, the exposed concrete slab itself serves as the floor. Toilet floors are of ceramic tile. The kitchen floor is of greaseproof asphalt tile, with a wood base.

Of its $193,400 budget, the church spent $8960 for its heating system. This represents a cost of 41c per sq ft of heated floor area.

The United Orthodox Synagogue

Located almost in the center of Norfolk is what is believed to be the first synagogue in America to use radiant heating. The United Orthodox synagogue is a large one-story structure, and its heating system required more than two miles of



EIGHT HEATING ZONES regulated by electronic controls are used at the Miles Memorial Methodist church. The electronic control boxes are shown on the panel board to the right of the circulators. Each zone has its own circulator and can be operated separately, so that certain functions — religious, social, recreational or educational — can be conducted without superfluous heating

THE UNITED ORTHODOX synagogue is a one-story, basementless structure. Note the seating areas at either side. They are the women's sections, and are raised by 21 in. to satisfy the orthodox requirement for separation of the sexes during services

wrought iron pipe. (Most of the piping is 1 in., and almost all of it is laid on 18 in. centers.)

The synagogue satisfied the orthodox requirement for separation of the sexes in a unique manner. Raised areas on either side of the auditorium are set aside for the women of the congregation. Another raised area is in the community hall wing, where a stage is set 3 ft above the floor level.

The Park Ave. Baptist church building measures 85 by 89 ft, with 12 rooms and the auditorium on the first floor and 19 rooms on the second. The second floor concrete slab is set on bar joists.

Ocean View Baptist church is unusual in that its radiant heating system really extends to three floors, the basement being at street level. It is the only one of the Norfolk churches of which this is true, and Smith ought to take a good look at it, for it refutes the idea that a radiant heating slab with wrought iron pipes embedded in it needs the immediate support of Mother Earth. The slabs above the basement are of bar joist construction, with a 3 in. concrete slab set over 3 by 4 in. mesh with attached builders' paper.

Not quite so unanimous in its adoption of radiant heating is the First Methodist church, which uses convectors in a balcony at the rear of the church because it is used only infrequently and can be closed off with a curtain. The rest of the church is radiant heated.

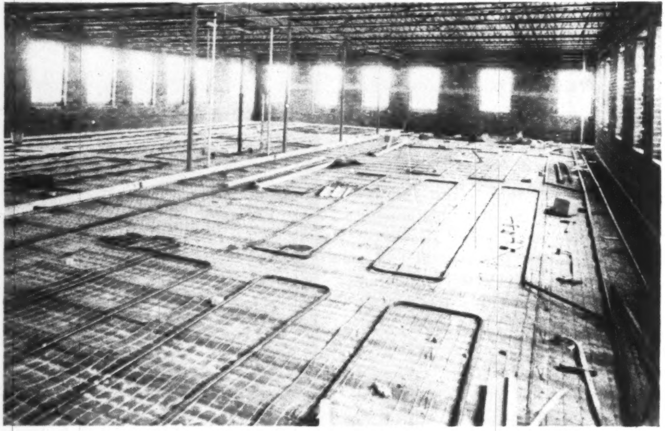
One of the popular applications of radiant heating has been in school buildings, and the same factors that fit it for ordinary classrooms also fit it for Sunday school rooms. With this in mind, radiant heating was specified for a 1949 Sunday school addition to Larchmont Baptist church.

Finally, a short ride across the Elizabeth river to neighboring Portsmouth would land our investigator at Redeemer Lutheran church, which houses the oldest of these new radiant heating systems. Completed in 1944, the one-story building uses 1 in. wrought iron pipe throughout (except for supply and return piping) compensating for the various heating needs by varying the spacing of the pipe.

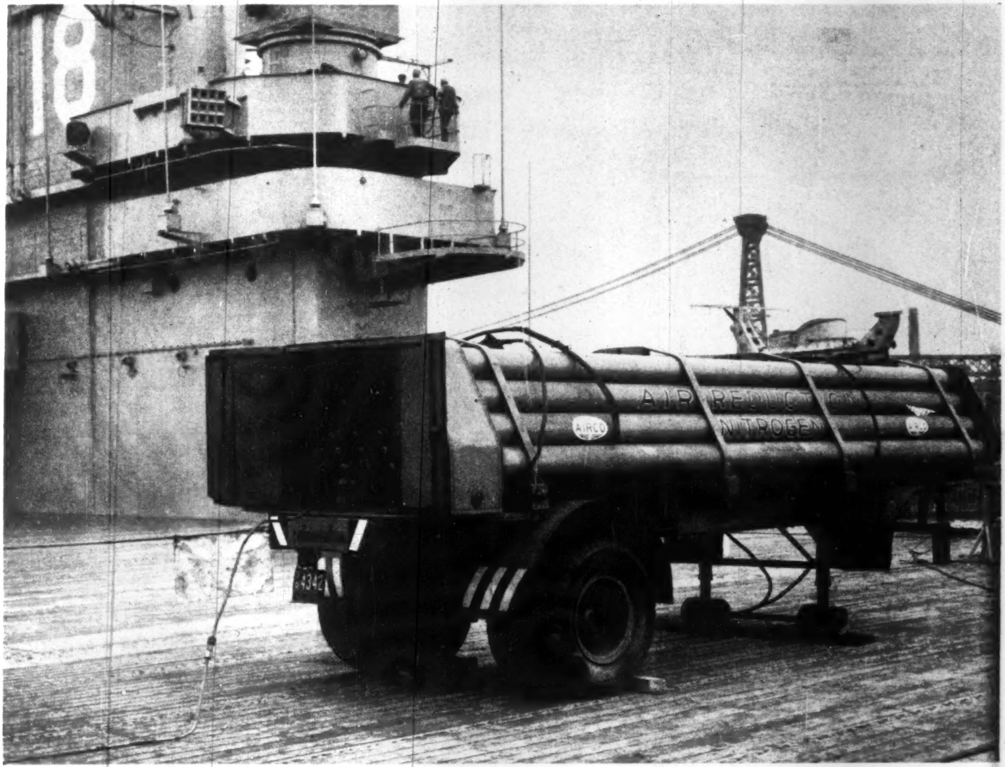
What Mr. Smith Would Learn

By the time Smith had finished his tour, he would have a pretty good idea of how radiant heating works in church structures. He would have seen systems employing every common pipe design: sinuous coils, prefabricated and site-fabricated grids. He would have had a chance to inspect how the system operates with a variety of floor coverings: concrete, wood, asphalt tile, linoleum, terrazzo, ceramic tile. He would have had the opportunity to compare several types of control systems. In short, he would have seen radiant heating adapted to different church buildings, different styles of architecture, different sets of specifications.

Most important, he would have gained a firsthand knowledge of the particular advantages that radiant heating holds for ecclesiastical structures: (1) It never interferes with the architectural design. (2) The absence of drafts makes for cleanliness, avoids streaking of walls. (3) Heat goes where the congregation is. The usual church, with its high overhead areas, is a "natural" for radiant heating. (4) Radiant heat is economical to operate.



THE PARK AVE. BAPTIST church contains 31 rooms in addition to the auditorium. This view shows wrought iron pipe being installed on the second floor. The concrete slab was set on bar joists which were covered with a coarse wire mesh concrete reinforcement to which was attached, on the underside, a tar paper



NITROGEN IS SUPPLIED to the testing equipment from a trailer carefully hoisted to the flight deck. Only in an emergency such as this, and then only under the supervision of a qualified expert in accordance with carefully planned safety procedures, should such a method be employed. [Official photograph, U.S. Navy]

"Set the Watch"

WITH THESE WORDS the crew took over as the Carrier Wasp once again became a full-fledged member of the U.S. Navy. With her log showing gallant service at Marcus, Wake, the Marianas, the Philippines and Okinawa, she was placed out of commission in 1947 and joined the mothball fleet. But two years later the wraps came off again and work was begun to convert the Wasp into the new jet warfare class. Although originally scheduled for completion this month, the deadline was later advanced six months and the New York Naval Shipyard came through with flying colors to meet this stepped-up program.

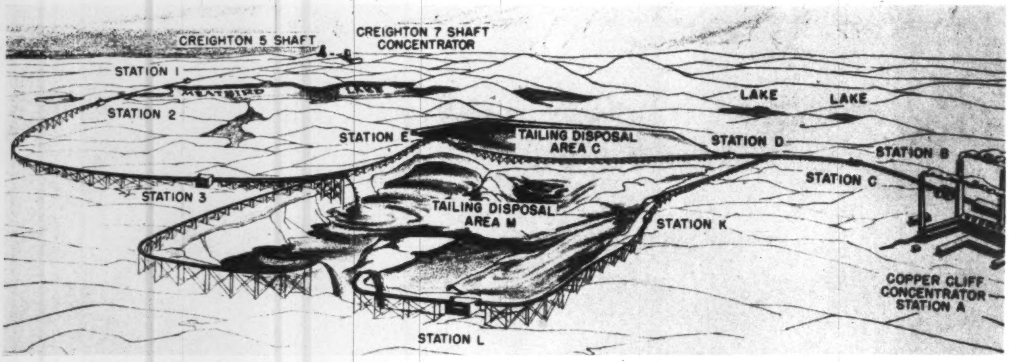
Every man-hour that could be saved was vital in making it possible to meet the schedule.

Purging and Testing the Piping

After years of inactivity, the miles of piping that make up the hydraulic and refrigeration systems had to be purged with an inert gas to remove air and moisture, and then pressure tested to insure trouble-free service. This operation required thousands of cubic feet of nitrogen which had to be supplied from a central point on the flight deck.

More than 2000 cylinders would have been required if this means of supplying the nitrogen had been employed. Instead, the nitrogen was delivered to the dockside in large tube trailers which were hoisted carefully to the flight deck.

As a result, the number of units handled was approximately 10, instead of more than 2000.



THE INSTALLATION represents the first time that concentrate pulps have been piped in such quantity over such a distance, it is believed.

Industry's Greatest Transportation System

PIPING is industry's greatest transportation system — when judged by miles in use, importance to modern manufacturing, or on almost any other basis. The new installation for conveying ore concentrate and waste material (tailing) at the International Nickel Co.'s development in northern Ontario is a striking example. Economies from pipe line transportation — along with others — make possible the working of lower grade ore

THE TALL STILTS of a wooden trestle more than seven miles long — marching across the outcrops, bush and muskeg of typically rugged northern Ontario country — carry the bulk concentrate produced at International Nickel Co.'s new 10,000 ton Creighton concentrator to the company's reduction plants at Copper Cliff. It's believed to be the first time that concentrate pulps have been piped in such quantity over such a distance.

The aerial artery through which the Creighton concentrate is pumped to the heart of Inco's reduction operations becomes part of the elaborate system which also carries tailing, or waste material, from both Creighton and Copper Cliff mills to the 1100 acre disposal area midway between the two plants. The system has 12 miles of trestle, at some points 65 ft high, and contains three million board feet of lumber and 40 miles of wooden pipe. It now transports as much as 30,000 tons of material in one day.

Handling Concentrate and Tailing

When the decision was made to build the Creighton concentrator as part of Inco's $130 million program of conversion to all-underground mining, steps were immediately taken to investigate the possibility of pumping the concentrate to Copper Cliff. To simulate actual operating conditions, an 8 in. wood stave pipe line 4000 ft long was installed at Copper Cliff and means provided for circulating through the line concentrate pulps of varying densities from the 30,000 ton Copper Cliff mill.

Information from these tests — pump capacities, head loss due to friction, maximum and minimum pulp velocities, etc. — demonstrated that concentrate could be pumped a pipe line distance of 7½ miles from Creighton to Copper Cliff with five relay pumping stations. Since three stations had to be built for Creighton tailing disposal, they were designed to allow for concentrate pumping also; two of the stations already in service to handle Copper Cliff tailing were enlarged to complete the facilities required for pumping the Creighton concentrate.

The four miles of new trestle from the Creighton plant carry two 8 in. concentrate pipe lines, two 13 in. tailing lines, a 6 in. water line enclosed in an insulated wooden box, and a walkway. The lines are all wood stave pipe; those for concentrate and tailing were tested at 110 lb per sq in. pressure and the one for water at 75 lb. From the point in the disposal area where Creighton tailing is dumped, the concentrate lines are installed on existing Copper Cliff tailing trestle for the remainder of the 7½ miles to the reduction plants.

For fire protection on the new trestle, corporation cocks for a 1½ in. fire hose are inserted in the water line every 600 ft, and fire hose is provided in boxes along the line. The complete system is patrolled four times every 8 hr.

The trestle extending from Creighton was built with a minimum 0.75 percent slope to and from each pumping station so that the concentrate lines would be self-draining in case of power difficulties. All concentrate from drainage is collected at each station in a spill sump which will hold three complete drainages from the concentrate lines. From the spill sump the drainage is pumped into the concentrate sump for return to the pipe lines.

Drainage from the tailing lines is arranged through quick dumping valves a short distance on either side of the stations.

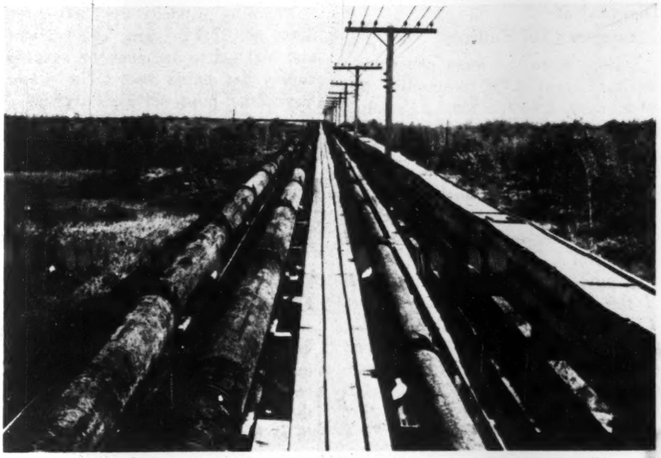
Pumping the Tailing and Concentrate Pulps

Of concrete, steel and cement block construction, the pumping stations are completely fireproof. Sumps to receive tailing and concentrate pulps form one wall of the building. Three 8 in. by 6 in. pumps for concentrate and three 10 in. by 8 in. pumps for tailing (all rubberlined) are installed in a straight line. Auxiliary gland water pumps and a vertical clean-up pump in the concentrate drain sump complete the installation.

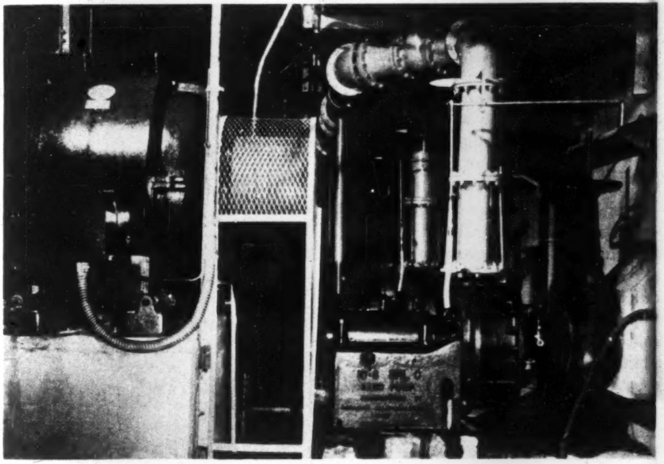
The specific gravity of the concentrate and tailing pulps varies with the mill tonnage; pipe line velocity and volume handled must remain reasonably uniform. When milling 10,000 tons a day, approximately 1800 tons of concentrate and 8200 tons of tailing are produced. Under these conditions, the concentrate pulp has a specific gravity of 1.28 with a flow of 800 gpm. The 8 in. by 6 in. concentrate pumps are designed so one pump will handle this flow through one 8 in. line with a velocity of 5.11 fps. Original test work showed the line loss due to friction when pumping 600 to 800 gpm to be 17.5 ft of head per 1000 ft of pipe. The longest concentrate pumping stage is a distance of 9700 ft, where the static head is minus 49 ft.

The tailing pulp has a specific gravity of 1.35 with a flow of 2500 gpm. The 10 in. by 8 in. tailing pumps are designed so one pump will handle this flow through one 13 in. line with a velocity of 6 fps. The loss in head due to friction in the line approximates 10 ft of water or pulp per 1000 ft of line.

The complete pumping system was designed for trouble-free operation despite the rigorous northern winter weather. The temperature has several times ranged to 30 deg below zero but there have been no operating difficulties.



THERE ARE 12 MILES of trestle, at some points 65 ft high, and 40 miles of wooden pipe. Tests on an 8 in. line 4000 ft long gave preliminary information on pump capacities, head losses, velocities, etc.



THREE NEW RELAY PUMPING stations were built, and two existing stations were enlarged. Pumps for concentrate and tailing are rubber lined.

Disposal of Copper Cliff Tailing

Tailing from the main concentrator at Copper Cliff, amounting to more than 500,000 tons a month, is collected in a central sump and pumped 1200 ft from the mill to five thickeners 110 ft in diameter and 12 ft deep. The pulp is thickened from 33 to 50 percent solids, the clear overflow water returning by gravity to the mill. The thickened pulp is then pumped 5000 ft to "C" station of the disposal system, from where it is relayed through pumping stations located around the perimeter of the disposal area. Four of these stations are "expendable" and must be relocated as the elevation of the disposal area is raised.

Between the rocky hills around the edge of the tailing area, dams have been built with tailing sands spigotted from the bottom of the wood stave pipes. Clear water from the tailing disposal area overflows through a reinforced concrete chimney 5 ft square, located in the lower elevation of the tailing area, and, after passing through a 1400 ft tunnel in a solid rock outcrop, travels to a storage area for use by the Copper Cliff concentrator.

The tailing lines are 16 in. wood stave pipe. They are installed with a minimum 0.50 percent slope to allow for line drainage through quick dumping valves at low points. Pumping stations are equipped with rubber lined pumps where water is available for gland sealing, and with steel lined pumps in other locations.

Specific gravity of the thickened tailing pulp from Copper Cliff is 1.48. When milling 30,000 tons per day, approximately 4500 gpm is pumped through the line with a velocity of more than 7 fps. The head loss due to friction in the pipe line is somewhat over 10 ft of pulp per 1000 ft of pipe.

Water Supply from Vermilion River

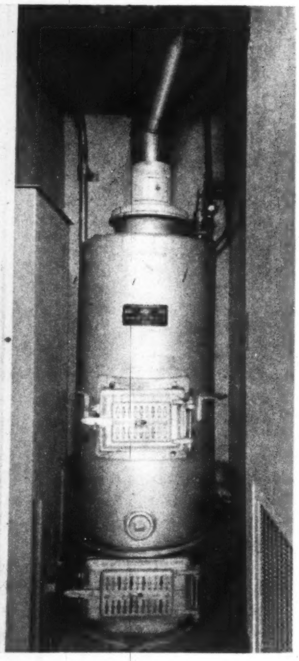
Another extensive pipe line project necessitated by the construction of the new mill at Creighton was the laying of a water line from the Vermilion river, six miles to the west. A pumping station was erected at the river and a 20 in. continuous wood stave pipe, built stave by stave in the field, was laid to a booster station built at Creighton.

Pumping capacity is 3500 gpm, 3000 gal for the new concentrator and 500 gal to augment the existing supply for mine use. The water leaves the pump at the river at a pressure of 125 lb per sq in. and arrives at the booster station at 1 or 2 lb; it is raised to 60 lb for use. The pumps at the river are operated by remote control.

Great Northern's Trains Have Auxiliary Heating

The Great Northern Railway's Empire Builder fleet, which entered service in June 1951, has auxiliary heating equipment in the mail-baggage, baggage-dormitory and all four coaches in each of the five trains in the fleet. Thus six of the 15 cars in each train have these installations, which were built in when the cars were constructed in 1950 and 1951.

The Western Star fleet, streamlined like the Empire Builder and in the same Chicago-Pacific Northwest service, has this equipment in the mail-baggage, baggage, and the four coaches. This again makes six cars on each of the six trains in the Western Star fleet. Each of these trains normally has about 14 cars, with the number varying. Five of these trains went into service in February 1947, under the Empire Builder name. The sixth was completely new last June when the six began running as the Western Star; this, of course, was when the present Empire Builder entered service. The five trains were equipped with the auxiliary heaters when built just prior to their 1947 inaugural, and the sixth train was similarly equipped when it was built to start running last June.



COAL FIRED heaters, all set to go at the touch of a match should the regular car heating check out for any reason, are used on the Great Northern's modern trains serving "the best of the Northwest"

The Great Northern's Red River streamliner, making a round trip daily between the Twin Cities and Grand Forks, N. D., is a five-car train that was completely new when inaugurated in June 1950. The baggage car and the three coaches in this train were equipped with the auxiliary heaters at the time of building.

Going back to before 1947 and the streamliners so equipped since, the Great Northern had auxiliary heaters on conventional-type cars, and still does.

The Empire Builder, Western Star and Red River cars so outfitted have a hot water type of heater. Entirely for auxiliary use to provide protection should the usual car heating check out for any reason, these systems are filled with a Prestone-water mix that circulates the full length of the car. The fuel in each heater is all set to go, with kindling and coal, and needs only the touch of a match. Hard coal is burned, and a supply of this is kept in a metal cabinet close to each heater. In the coaches, heater and coal supply are enclosed in a metal compartment toward one end of the car. Access is gained by opening a door off the aisle.

Simplifying the Choice of Cooling and Dehumidifying Equipment

Melvin A. Ramsey, Contract Engineering Div., Worthington Pump and Machinery Corp., concludes his discussion of solving air conditioning problems with the psychrometric chart. Factors involved in selecting coils are considered, and two variations of the example are analyzed to bring out further information

AFTER A REASONABLY good coil selection has been made, it is then only necessary to calculate the desired refrigerant temperature and select a compressor having the desired capacity at that refrigerant temperature. There are many variables affecting the difference in temperature between the refrigerant and the average surface. Much depends on the characteristics of the particular coil, and the different manufacturers have curves or other means for obtaining the difference between refrigerant and average surface temperature for their coils. For this reason, the subject will not be discussed here except in a general way.

For the coil chosen for the problem under consideration in the February article, the refrigerant temperature will probably be about 14 deg below the average surface temperature, or 51 — 14 = 37 F. Suppose, in selecting a compressor, it is found that one size permits 175,700 Btu per hr only if the refrigerant temperature is 40 deg or higher. To go to the next larger size of compressor will add considerably to the cost of the job. It will probably be found that, with a six row coil instead of four rows, and passing a little less than 5000 cfm over the coil, the refrigerant temperature resulting will be higher than 40 F. It is very likely that the extra cost for two more rows will be less than the extra cost for the next larger compressor, etc. Even if it were the same, the six row coil solution would result in a lower operating cost.

The actual face area of the coil may be a little larger, or even slightly less than calculated, in order to conform to standard sizes. Over 500 fpm face velocity results in fairly high friction over the coil and there is considerable probability of water being taken off the coil and carried along with the air stream. Too much less than 500 fpm face velocity means a lower coefficient of heat transfer for the outside surface and less heat transfer results from a given amount of coil. Therefore, unless other restrictions or considerations affect the decision as to the face velocity, it will usually be 450 to 500 fpm.

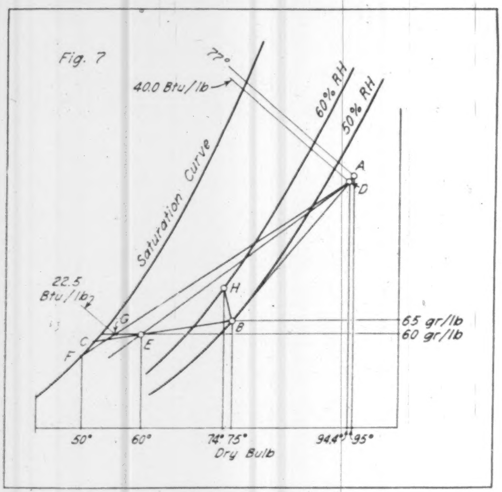
Number of Rows To Use

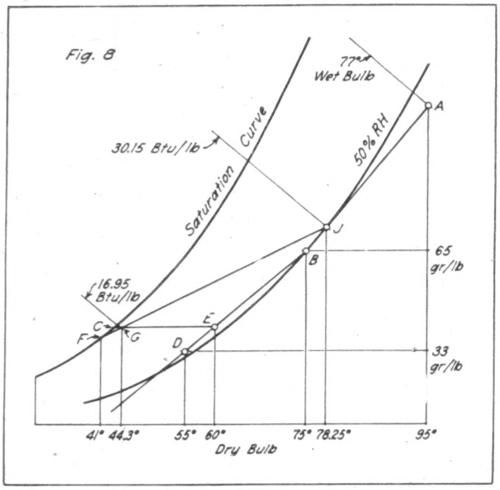
It will be noted that the particular problem could have been taken care of with two, three, four or six rows. It can readily be seen that a workable design would result with anything from one row to 10 or even more rows. Basically then, it is not a particular latent to sensible heat ratio which determines the number of rows. It is determined by the choice which results in the lowest investment cost, operating cost or combination of the two. If a plant were to run only 1000 hr per year, a four row coil might have seemed a good choice. However, if the same plant was to operate 8000 hr per year, the saving in operating cost with a six row coil or even eight rows, or a lower face velocity, might pay in a reasonable time for the additional investment.

No simple, direct rules can be given as to what number of rows and what face velocity will be the best for any particular problem because they depend on too many factors, including just how the load fits in with standard compressor, motor and conditioner capacities, etc. The ability of the air conditioning engineer to fit together the available standard equipment so as to solve, in the best and most economical manner, any particular problem is one of the main things that determines his usefulness and value.

If the cooling coil is to be water cooled instead of direct expansion, inlet and outlet water temperatures can usually be calculated from the inlet and outlet air conditions, the number of rows, face velocity, etc., by using data given by the manufacturer of the particular coil to be used. There is a reasonably direct method which fits all coils when a table for tube velocities with different arrangements is made, but the description of this is not within the limits of this article.

If a washer is to be used, the same method of solution, as described above, is applicable. Tables are available, in various books and manufacturers' data, giving what is often referred to as "saturation efficiency". This could be called "contact factor" instead and when 95 percent is given the contact factor is 0.95. The problem is therefore solved in exactly the same manner but the contact factors are the more limited ones (they are all rather high) for washers. The temperature indicated by the intersection of the line on the psychrometric chart showing the change in





condition of the air passing through the washer with the saturation curve, is that of the water leaving the washer. The temperature entering the washer must be less and the number of degrees less determines the quantity of water to be circulated to remove the 175,700 Btu per hr. Too small a temperature difference results in excessively high water circulation. If too large a difference is depended on, it may not be attained in practice. For further discussion of the quantity to be circulated and the temperature difference, reference should be made to books on the subject and to manufacturers' data for the actual washer to be used.

Assume Two Variations of the Problem

Let us assume two variations in the preceding problem:

1) The outside air quantity is to be 6000 instead of 1000 cfm but all other requirements are to remain unchanged. This makes the total heat to be removed from the outside air = 6000 × 4.5 (40.55 — 28.2) = 334,000 Btu per hr. This, added to the 120,000 Btu per hr from the space, gives a total of 454,000 Btu per hr.

Lines *AB* and *BC* are the same as previously (see Fig. 7).

Again, 60 deg might be tried as the air temperature leaving the coil and this will result, in the same manner, in 6170 cfm to be circulated through the coil. The temperature of the air entering the coil will be 75 + (6000/6170) (95 — 75) = 75 + 19.4 = 94.4 deg.

A point should be located on line *AB* at 94.4 deg (*D*) and on *BC* at 60 deg (*E*), and a straight line drawn through these two points, extending to the saturation curve, if possible. In this case it will be noted that *DE* does not intersect the saturation curve. This indicates a change of air conditions which cannot be attained by means of a cooling and dehumidifying coil or a washer. A try can be made at drawing a line parallel to *DE* and to the left of it in an attempt to reach the saturation curve. If this can be done with *DE* still intersecting *AB*, that would be a satisfactory solution. In this case a line cannot be drawn parallel to *DE* and intersecting both the saturation curve and *AB*. There are two basic methods of changing air at condition *D* to condition *E*. As will be seen, there are an infinite number of combinations, with variations of bypass, total air circulation, surface temperature, etc., and this again is where judgment is required. The plotting of the solutions on the psychrometric chart helps to make the process clear and helps to point toward the different possibilities and effects.

One method is drying by means of adsorption or absorption. In this case the condition of the air changes approximately along a wet bulb line, in the direction of increasing dry bulb and decreasing gr/lb. The air at condition *D* must change to a point where it is mixed with 60 gr/lb of moisture which corresponds to the moisture content at point *E*. If the gr/lb leaving the dryer are less than 60, less than the total quantity of 6170 cfm may be taken through the dryer and mixed with the remainder to give a mixture having 60 gr/lb. This would then be cooled to 60 deg, or point *E*, as required.

Alternatively, the smaller quantity at less than 60 gr/lb may be cooled to where it intersects the extension of *DE*, and mixed with the remainder of the 6170 cfm at condition *D*, to result in a mixture at condition *E*. Even if the moisture content, after air at condition *D* had passed through a dryer, were somewhat more than 60 gr/lb, it is quite possible that it may be cooled and dehumidified in such a way as to reach condition *E*. Indication of the processes on the psychrometric chart will show — reasonably quickly — what is possible or practical.

The second method is to pass the air at condition *D* over a surface of suitable temperature. The air leaving the surface (coil or washer) is then heated, without changing its moisture content, to a condition somewhere on line *BC*. The location of the point on line *BC* determines the quantity of air to be circulated per unit time. If it is desired to use 6170 cfm without bypassing any part of it, one solution might be to pass the 6170 cfm over a coil with an average surface temperature of 50 deg (draw line *DF*). The contact factor in this case must be [(94.4 — 55)/(94.4 — 50)] = 0.89, since the leaving air must have a moisture content of 60 gr/lb and the intersection of *DF* with 60 gr/lb (point *G*) occurs at 55 deg. The 55 deg air is then heated to 60 deg and its condition is represented by point *E*.

To check calculations:

The heat removed by the cooling and dehumidifying coil = 6170 × 4.5 (40.0 — 22.5) = 486,000 Btu per hr.

The heat added by the heating coil will be 6170 × 1.08 (60 — 55) = 33,000 Btu per hr.

Thus, the refrigeration load will be 486,000 Btu, the heating load 33,000 and the net heat removal from the conditioned space and outside air = 486,000 — 33,000 = 453,000 Btu per hr, which is reasonably close to the 454,000 Btu required.

Avoiding Reheat

This problem required reheat, as shown, basically because the outside air requirements were large in proportion to the latent and sensible heat to be removed from the room. There are some cases where a relative humidity of 60 percent with the same "effective temperature" ("effective temperature" lines for low velocity air are approximately parallel to the constant volume lines indicated, on the psychrometric chart, in "Cu Ft per lb of Dry Air") might be acceptable. This would be a room condition corresponding to point *H*, Fig. 7. If this problem is solved with this as a room condition, it will be found that reheat is not required and the total refrigeration load will be less.

If a higher relative humidity is acceptable, reheat can be avoided in a problem where the quantity of outside air is what makes it necessary. However, the relative humidity may become very high and even 60 percent may be unsatisfactory for many requirements. This possibility of changing room conditions is mentioned because there are times when the purchaser may be willing to accept such a change if he realizes that the cost of the installation and the operating cost will be less due to the change. Sometimes it will be found that the alternate conditions are fully as satisfactory, in any case, as those originally specified.

2) Assume that the latent heat from the space is to be 100,000 Btu per hr instead of 20,000, but all other requirements are to remain unchanged. This makes the total heat from the space 100,000 sensible plus 100,000 latent or 200,000 Btu. This added to the total heat from the outside air (55,700) results in a total of 255,700 Btu per hr to be removed.

Locate, on the psychrometric chart, point *A* representing the outside condition and point *B* representing the room condition (see Fig. 8).

It is now necessary to draw the line representing the locus of all possible room entering conditions. Its slope will be represented by 1.6 × (100,000/100,000) = 1.6 gr/lb for each degree. If a point is to be located at 55 deg (20 deg below the 75 deg room temperature) it would be 20 × 1.6 = 32 gr/lb less than the approximately 65 gr/lb at room conditions, or 65 — 32 = 33 gr/lb. Point *D*, on the locus, is then located at 55 deg and 33 gr/lb and line *BD* is drawn, extended. It will be noted that this lines does not intersect the saturation curve. This makes it necessary to use reheat. (Reheat might be the most practical solution even if line *BD* did intersect the saturation curve, if the point of intersection is too near or below 32 deg because, otherwise it might be necessary to accumulate some or all of the condensed water as ice on the coil, with all the extra problems which result.)

To keep the problems similar, 60 deg might again be used as a reasonable room entering condition and no bypass considered for the moment. Point *E* is then located on *BD* at 60 deg. The line indicating the change in condition, as the air is heated to the condition represented by point *E*, would be a horizontal one from a point near the saturation curve. Therefore, this horizontal line *EC* should be drawn. The condition of the air leaving the cooling and dehumidifying coil or washer must be on this line *EC*.

Since the temperature of the air entering the room is to be 60 deg (as in the first selection), the total circulation is 6170 cfm. With 1000 cfm outside air, as before the temperature of the air entering the coil will be 78.25 deg and the condition will be 78.25 deg on line *AB*, or point *J*. A line must now be drawn through *J* which intersects both *CE* and the saturation curve. There are any number of locations for this line but line *JF* in Fig. 8 is a reasonably good first try in that it keeps the average surface temperature (point *F*) about as high as possible for a reasonable contact factor. With these conditions, the contact factor required is (78.25 — 44.3)/(78.25 — 41) = 0.91.

If a coil of the average finned type for air conditioning is chosen on the basis of a 450 to 500 fpm face velocity, it is very likely that the refrigerant temperature will be below freezing. This in itself is not a limiting factor, but is of interest in that, the lower it is, the more power will be required for a given refrigerating capacity. What may be a limiting factor is that the last row of the coil (in the direction of air flow) might have a surface temperature below freezing. In such a case, a deeper coil may be selected which would raise the temperature at *F* and lower that at *G*, as these points approach each other. Another problem may occur with the usual standard coil in that, with an eight row coil, which it might be thought desirable to use, the pressure drop in the refrigerant circuit may be too great with such a large total heat difference between air entering and leaving the coil.

This can be helped by using (say) two four row coils instead of one eight row or by using a larger face area with the resulting lower face velocity. Further information on the refrigerant side conditions in the coil cannot be included here but data is available in technical literature and manufacturers' catalogs, etc.

If this solution is to be used, the air enters the cooling coil at 78.25 F dry bulb, 65.2 F wet bulb and 30.15 Btu per lb enthalpy and leaves at 60 F dry bulb, 43.6 F wet bulb and 16.95 Btu per lb enthalpy. It then passes through a heating coil where its temperature is changed from 44.3 to 60 F dry bulb.

The heat removed by the cooling coil is 6170 × 4.5 (30.15 — 16.95) = 366,000 Btu per hr.

The heat added by the heating coil is 6170 × 1.08 (60 — 44.3) = 105,000 Btu per hr.

Thus, the refrigeration load will be 366,000 Btu, the heating load 105,000 Btu and the net heat removal from the conditioned space and outside air = 366,000 — 105,000 = 261,000 Btu, which is reasonably close to the 255,700 required.

If the locus of all possible room entering conditions (*BD*, Fig. 8)

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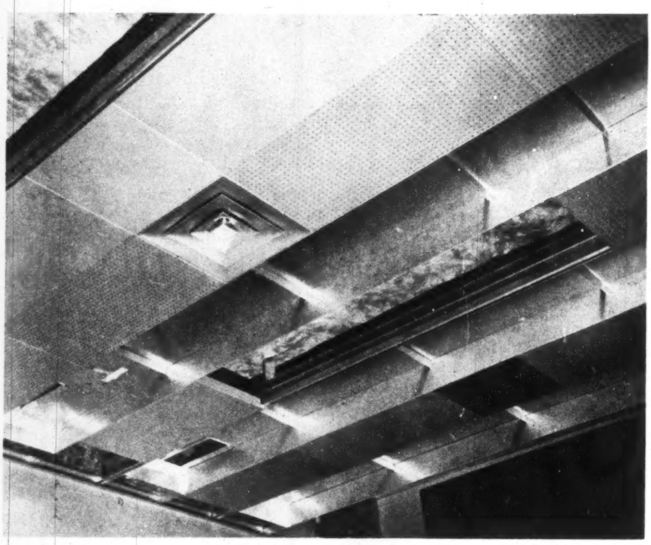


THE CEILING CONSTRUCTION, using about one-third of the ceiling for air panels, one-third for acoustical treatment, and one-third for lighting. Air flows in a sinuous pattern back and forth within the ceiling and is then discharged to the room through a diffuser. The test room was 10 ft wide, 13 ft long and 6 ft, 1 in. high

Tests Air Panel Heating, Cooling for Floor or Ceiling Use

By R. P. Goemann
Chief of Heating & Ventilating Section
John D. Dillon, Consulting Engineers

Heating or cooling by means of air circulated within either floors or ceilings — the air being subsequently discharged into the room — has been an objective of the John D. Dillon consulting engineering organization, and many methods of construction have been developed, two of which are described. Results of a test installation are given briefly

PANEL HEATING and cooling, using air as the heat transfer medium, has been a prime aim of development in our organization for the past few years. A test room was recently set up to give us observed results of two types of panels adaptable to commercial applications, and some actual installations are near completion.

Floor Panels of Cellular Steel

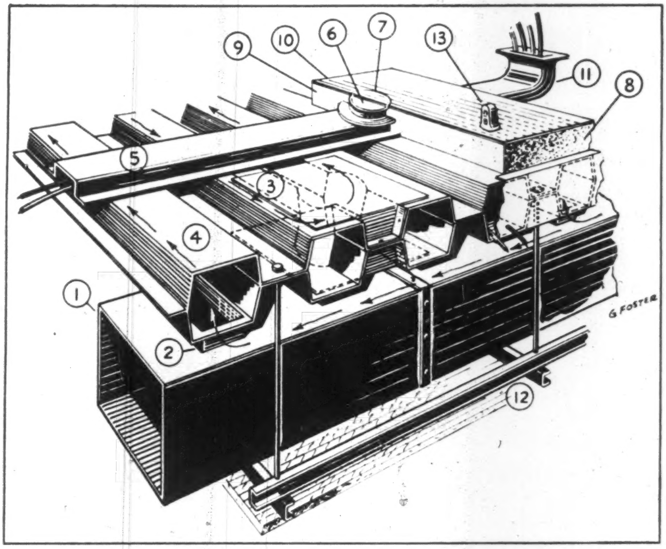
The floor system is, we feel, a good solution for multi-story buildings. The basic material used is a cellular steel panel which has been widely employed as a structural subfloor. The panels are welded to the steel frame of the building and topped with a 2½ in. poured concrete floor.

Some of the cells have been used for years as an electrical distribution system to provide electrical service outlets at any location as required for complete wiring flexibility. We are using the cells of the floor for the air panels also without affecting other uses.

The heating and cooling of the building is installed as the building structures goes in place. From the mechanical plans, the steel erector cuts the return bends and inlets and outlets from the panels. The heating contractor then connects the panels with the sheet metal duct work. In the first installation with this type of system, in a one story office building of 7200 sq ft, the mechanical contract for panel heating and cooling came to 8½ percent of the total job.

Aluminum Pan Ceiling

The ceiling panel scheme we have developed is also adaptable for multi-story buildings and is very flexible — and saves space — for remodeling



FLOOR PANEL SCHEME uses cellular steel panels which have been widely employed as structural subfloors. 1, supply air duct. 2, sheet metal duct collar. 3, 180 deg turn. 4, structural floor. 5, crossover wireway. 6, hand-hole into cell. 7, plate covering used hand-hole. 8, floor sealing plate. 9, lightweight fill. 10, floor finish. 11, ell connecting crossover wireway with electrical panel box. 12, suspended ceiling. 13, electrical floor outlet

existing interiors. This system has been developed from basic aluminum metal pan ceiling. A combination of acoustic and solid duct pans are integrated with lighting and air diffusers. The air flow in this panel has also been developed in a sinuous pattern, as is the case with the floor system.

The thickness of the ceiling is 4 in. and at the return bends it is 8 in. — approximately the same depth as a troffer lighting fixture.

A basic prinicple of the air panel system on the cooling cycle is that the air leaving the cooling and dehumidifying equipment is at a temperature lower than with conventional air conditioning designs. The air is heated up in the panel and does useful work by extracting heat from the room. The lower temperature permits less air to be used. The panel acts as a reheater, and all the air flows through it before being discharged to the room.

Temperatures With Test Installation

The test room installation was controlled by a pneumatic master — sub-master cycle. The room temperature was varied within a wide range without a noticeable effect to the occupants. We did find, with floor temperatures below 61 F, that a feeling of discomfort was noticed — especially with women due to their thin soled shoes (this was while in a sitting or at a rest position). It was observed that ceiling temperatures as low as 54 F had no uncomfortable effect on any occupant.

The air temperatures entering the floor panels were as low as 45 F, while the ceiling panel should operate in the range of 55 F. Below this point of ceiling operation, it is possible at times to hit a point of condensation. The floor panel was watched very closely for condensation — the concrete slab, cell interior, and the exterior. While operating under these conditions, we have had as many as 14 people in the space at one time on a day of high humidity, with the door from the test room to the outside being opened at an abnormal rate, without the development of condensation.

The author wishes to express his appreciation to John K. Fairbairn for our past association and for his early work on the systems.

SIMPLIFYING—

[Concluded from page 97]

doesn't pass too far to the right of the saturation curve, there are times when it might be acceptable to increase the relative humidity to be maintained to a point where the locus intersects the saturation curve. In this particular case, it is very doubtful because it would require 75 to 80 percent relative humidity. In some cases the slope of this locus of all possible room entering conditions (sometimes called the "room condition line") will be such that no change of conditions to be maintained will cause it to intersect the saturation curve.

This problem just considered with reheat could, of course, have been handled with adsorption or absorption or any combination of that system with refrigeration. The question as to which is the best system depends, as usual, on economic factors — such as cost, temperature and availability of cooling water, cost and temperature of heat for reactivating the drying material, cost of power, etc.

Check the "Design Conditions"

In considering all of these problems, the outside conditions have been taken at a point which is used as the "design condition" in some localities. Consideration should be given to the fact that "design conditions" seldom occur and the air conditioning system should be capable of maintaining satisfactory inside conditions when other than "design conditions" exist. A check of one or two possible extremes thus is often desirable.

In these problems, it might be wise to check what could be done if, instead of 95 F dry bulb and 77 F wet bulb, the outside condition is 80 F dry bulb with 77 F wet bulb. Quick approximations of the new space sensible and space latent (space latent usually doesn't change with outside conditions unless there is infiltration) loads can be made and it can readily be seen, when the problem is plotted on the psychrometric chart, whether reheat, bypass of recirculated air or some combination is required to maintain the inside conditions specified or a sufficiently close approach to the conditions, to meet the requirements of the case.

[Concluded]

Eliminating Noise Transmission in Liquid Pipe Lines

By Martin Hirschorn
President, Industrial Acoustics Co., Inc.

Most liquid pipe noise problems can be solved by the installation of commercially available noise attenuating couplings; however, occasionally pump system noise problems may arise, due to high pump speeds or other complex conditions, which cannot be solved by available commercial equipment. In such cases, an acoustical analysis of the problem will indicate the correct method of solution and may involve the use of special pressure release wall couplings

THE PROBLEM OF pipe line noise transmission is frequently encountered, and resulting complaints have often proved very troublesome to consulting engineers and contractors.

Simple methods for eliminating this problem in the majority of cases are available. The use of commercially available noise attenuating couplings and a new design for the solution of unusual noise transmission problems are described here.

Discussion of the Problem

In industrial practice, the problem of pipe line noise is generally regarded as one of preventing noise transmission along the pipe wall itself. This means that noise transmission through the water or liquid column is considered to be negligible. It is well known that inserting a material of small acoustical impedance in a pipe line will result in a satisfactory degree of noise attenuation. The material frequently used is a tube constructed of rubber and canvas composition with a steel wire reinforcement embedded within the rubber or on the outside of the tube. The measurement of actual noise reductions obtainable by means of such pipe line inserts has been studied by a number of investigators.

Constable (Reference No. 1) reports that canvas reinforced rubber tubes, 1 in. and 1½ in. in diameter, 3/16 in. thick and of various lengths, gave attenuations of 17 decibels per ft at 200 cycles per sec and 30 db per ft at 1000 cps. He obtained the same attenuation through a water filled tube as through an empty tube. Ganitta (Reference No. 2) reports an attenuation of 7.5 db per meter (2.3 db per ft) at 200 cps and of 18 db per meter (5.5 db per ft) at 1000 cps in a similar water filled tube, 5 cm (1.97 in.) internal diameter, 0.7 cm (0.276 in.) thick and 9.4 meters long. He obtained an attenuation approximately 5 db per meter higher with the same empty rubber tube but strengthened with wire.

The difference in values obtained by the two investigators can probably be attributed to the different conditions of the experiments, but both investigations reveal a relatively high attenuation in the rubber tube, both in the pipe wall path and the liquid column path.

The effect of pressure, or increased internal stress, on rubber and other couplings has been investigated to some extent (Reference No. 3) and it would appear that the use of a large amount of rubber is desirable for good attenuation characteristics at high pressures. The alloy copper-manganese is of particular interest in this connection, since it is reported (Reference No. 4) that it has very high damping characteristics which improve with increasing stress.

In commercial and industrial practice, water column noise transmission as distinct from pipe wall noise transmission has hitherto been no real problem. This is no doubt due to the fact that most of the pumps currently in use are of comparatively low speed, 1800 rpm being a common value. A pump speed of 3600 rpm or higher will probably introduce water column noise transmission, and in such a case the use of a rubber coupling alone will be comparatively ineffective. The wave motion transmitted along the water column in such an instance will be a function of the pump speed and the number of impellers on the rotor. Accordingly, if the pump speed is N rpm and the number of impeller blades is n, then the fundamental frequency f will be:

$$f = [(N \times n)/60] \text{ cycles per sec} \quad \ldots\ldots [1]$$

Preliminary experimental investigation has indicated that water column noise transmission can be eliminated by the use of pressure release wall materials, which will be discussed later.

Pipe Wall Attenuation

Each material has a definite acoustic resistance, measured in acoustical ohms, which is derived from an analogy with Ohm's Law for electrical waves. This acoustic resistance z, is a function of the density of the material and the velocity of sound through the material.

$$z = \rho c \quad \text{.........}[2]$$

where ρ = density, grams per cu cm; c = velocity of sound through material, cm per sec.

Typical values for z are given in Table 1. Rubber has a very low and steel a very high acoustic resistance.

The following formula gives the attenuation of sound transmission along the walls of a metal pipe by means of a rubber insert (Reference No. 5):

$$Pr = (\text{Power transmission through insert})/(\text{Power transmission without insert}) = 4r/(r + 1)^2 \quad \text{.........}[3]$$

where Pr = power ratio; $r = z_1/z_2$ = ratio of specific acoustic resistances of metal pipe and rubber insert.

The acoustic resistance z for copper, for example, is 3.20×10^6 g/cm² sec and for rubber 0.003×10^6 g/cm² sec. Therefore, $r = (3.20 \times 10^6) / (0.003 \times 10^6) = 10.66 \times 10^2$

On substituting in Equation 3, we get $Pr = 0.375 \times 10^{-2}$. From this, the attenuation R can be calculated:

$$R = 10 \log Pr = -44.3 \text{ db} \quad \text{...}[4]$$

The above equation and calculation does not take into consideration the effect on attenuation of pipe length, diameter or frequency. However, Constable concluded the following from his experiments:

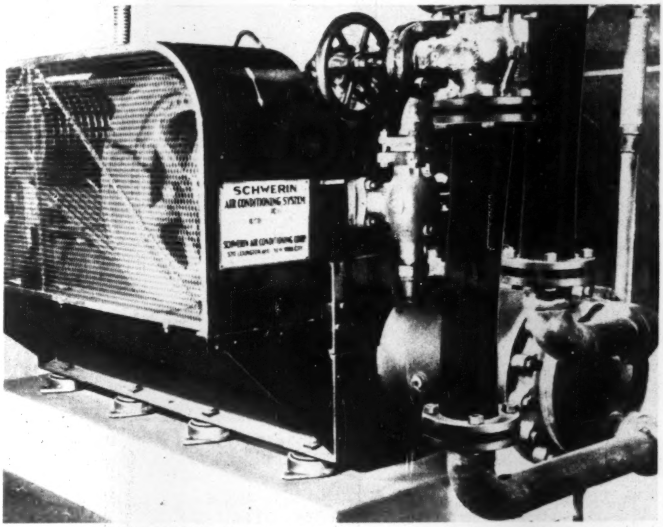
1) The attenuation for a given length of rubber insert increases with the test frequency up to about 7000 cps and then decreases.

2) The attenuation for a given frequency increases with the length of rubber insert.

3) Canvas reinforced rubber is not as effective as plain rubber.

4) No change in attenuation was observed for the various cross-sections which were tested; that is, 3/4 in. to 1½ in. diameter.

5) For insulation of low frequency sound, a long length (i. e., several feet) of rubber tube is required, whereas high frequencies can be eliminated by a comparatively short length of rubber hose.



SOUND ABSORBING installation in the suction and discharge lines of a water pump in the air conditioning system of a large bank, where noise and water hammer transmissions throughout the 18 story building were eliminated

TABLE 1—TYPICAL ACOUSTIC RESISTANCES of various materials

Material	Sound velocity (c) cm/sec	Density (ρ) g/cm³	Acoustic Resistance ($z = \rho c$)
	$\times 10^5$		$\times 10^6$
Aluminum	5.25	2.65	1.39
Copper	3.58	8.93	3.20
Cast iron	3.85	7.7	2.96
Steel	5.05	7.8	3.93
Lead	1.2	11.4	1.37
Nickel	4.76	8.9	4.23
Silver	2.74	10.5	2.88
Tin	2.72	7.3	1.96
Brass	3.42	8.5	2.90
Ivory	2.2	1.85	0.41
Pitch	0.68	1.1	0.075
Paraffin wax	1.46	0.9	0.13
Rubber	0.03	0.95	0.003
Oak	4.05	0.8	0.32
Ice	3.2	0.92	0.29
Concrete	3.1	2.6	0.81
Cork	0.50	0.24	0.012
Water (fresh)	1.48	0.998	0.148
Water (sea)	1.50	1.0234	0.1535
Air	0.3316	1.293×10^{-3}	0.0000428

Pressure Release Wall Attenuation

The compressibility of a liquid is comparable to that of a solid and is very much less than that of a gas. Consequently, at a node in a liquid where the pressure fluctuation is a maximum there will be a swelling of the tube, whereas no such effect will occur at the anti-node. This swelling of the tube results in a corresponding drop in pressure and a lowering of the velocity of wave propagation in the liquid column. This reduced velocity can be calculated from Korteweg's formula:

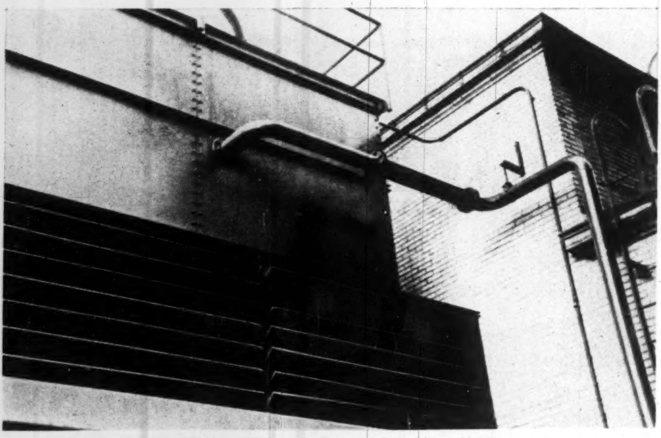
$$c_o^2/c_R^2 = 1 + \{2 E R/[a E_1 (1 - 5a/6 R)]\} \quad \text{.........}[5]$$

where c_o = velocity of sound in free fluid; c_R = velocity of sound in fluid of pipe; E = elasticity of fluid = ρc_o^2; E_1 = elasticity of walls of pipe; R = radius of tube; a = thickness of wall; ρ = density of fluid

Ganitta derived from Korteweg's formula the following expression for the damping coefficient:

$$\beta_R = 2\pi \times \epsilon \times c_R \times N \times \eta \times f \quad \text{.........}[6]$$

where β_R = attenuation, nepers per cm; $N = R/a\,E_1$; $\epsilon = \rho/(1 - 5a/6R)$; η = a friction coefficient (typical values for η are as follows: Steel, 5×10^{-1}; brass, 1×10^{-3}; glass, 2×10^{-3}; rubber 1×10^{-1}); f = frequency.



COOLING TOWER installation, where noise transmission to the upper floors of the building through pipe hangers in the pipe line was eliminated

The above equation indicates that a small modulus of elasticity and a high friction coefficient are essential properties for a material used in connection with a liquid column noise attenuator.

The theoretical attenuations for three types of pressure release materials are calculated below.

Sponge Rubber

If: $R = 1$ in., $a = 0.485$ in., $E_1 = 15$ lb per sq. in. $= 1.03 \times 10^6$ dynes per sq. cm.

Substituting these values, the following is obtained: $N = 2 \times 10^{-6}$ and $\epsilon = 1.68$

Substituting in Equation 5 the appropriate values for water, $c_o = 1.43 \times 10^5$ cm per sec and $\rho = 1$ gm per cm^3, $c_o/c_R = 372$ is obtained. That is, $c_R = 385$ cm per sec.

Now substituting in Equation 6, $\beta_R = 2\pi \times 1.68 \times 2 \times 10^{-6} \times 385 \times 0.1 \times f = 0.815 \times 10^{-3} \times f$ nepers per cm $= 0.214 \times f$ db per ft.

This gives, at 100 cps, $\beta_R = 21.4$ db per ft, and at 1000 cps, $\beta_R = 214$ db per ft.

Thin Metal Tube (Copper)

If: $R = 1$ in., $a = 0.01$ in., $E_1 = 11.5 \times 10^{11}$, $\eta = 1 \times 10^{-3}$.

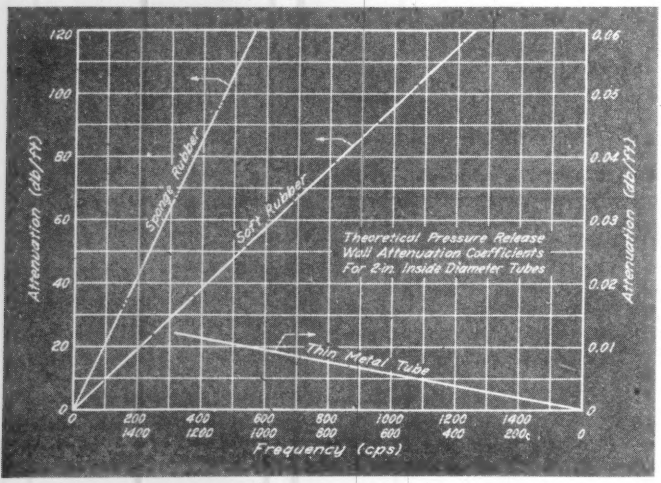
Substituting these values, the following is obtained: $N = 0.87 \times 10^{-10}$ and $\epsilon = 1$.

Again, substituting in Equation 5 the appropriate values, then $c_o/c_R = 2.15$ and $c_R = 0.67 \times 10^5$ cm per sec.

Now, substituting in Equation 6, $\beta_R = 2\pi \times 1 \times 0.87 \times 10^{-10} \times 0.67 \times 10^5 \times 10^{-3} \times f = 3.65 \times 10^{-8} \times f$ nepers per cm $= 0.96 \times 10^{-5} \times f$ db per ft.

This gives, at 100 cps, $\beta_R = 0.00096$ db per ft, and at 1000 cps, $\beta_R = 0.0096$ db per ft, and at 10,000 cps, $\beta_R = 0.096$ db.

PRESSURE RELEASE wall attenuation vs. frequency. (Sponge rubber and soft rubber, 0.485 in. thick; thin metal copper tube, 0.01 in. thick)



Soft Rubber Tube

If: $R = 1$ in., $a = 0.485$ in., $E_1 = 150$ lb per sq. in. $= 1.03 \times 10^7$ dynes per sq cm, $\eta = 10^{-1}$.

Substituting these values, the following is obtained: $N = 2 \times 10^{-7}$ and $\epsilon = 1.68$.

Again, substituting in Equation 5 the appropriate values, then $c_o/c_R = 82$ and $c_R = 1750$ cm per sec.

Now, substituting in Equation 6, $\beta_R = 2\pi \times 1.68 \times 1750 \times 2 \times 10^{-7} \times 10^{-1} \times f = 0.366 \times 10^{-3} \times f$ nepers per cm $= 96.6 \times 10^{-3} \times f$ db per ft.

This gives, at 100 cps, $\beta_R = 9.6$ db per ft and at 1000 cps, $\beta_R = 96$ db per ft.

The results of the above three calculations are shown in the accompanying graph and indicate the attenuation obtainable through a thin metal tube is negligible. On the other hand, the attenuation through the sponge rubber and soft rubber is theoretically very high. The effect of pressure on attenuation has not yet been adequately studied; however, it can be anticipated that the subjection of sponge rubber to a relatively high pressure will destroy most of its pressure release characteristics. The problem then is how to retain the pressure release characteristics of sponge rubber, or soft rubber, under high pressure.

One way in which it appears this could possibly be done is to protect the sponge rubber by means of a stronger tube, though the attenuation characteristics of this combination would necessarily be reduced. Nevertheless, it would seem worthwhile to investigate this method further on an experimental basis by using different materials for such a protective tube, both perforated and solid. Further, various types of rubber compositions should be tested with and without a protective tube.

[Photos courtesy T. R. Finn & Co., Inc.]

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2) Untersuchungen uber die Schalleitung in wassergefullten Rohren, by Eugen Ganitta, *Akustische Zeitschrift*, V 5, pp. 87-102, September 1940.

3) Reduction of Noise in Piping Systems (Liquid), Report No. 11, April, 1951, Project No. 90-874, Navy Dept., Bureau of Ships.

4) The Damping Capacity of Copper Manganese Alloys, by R. S. Dean and others. *Transactions* of the A. S. M., Vol. 40, p. 355.

5) *Acoustics*, by Stewart and Lindsay, p. 95.

THE SMALLER DUCTS took some wriggling to do the work . . . .

Duct Cleaning Job Requires Acrobatic Ability

Squeezing and wriggling your way into the smaller ducts of a big ventilating and air conditioning system to clean them is really a job for an acrobat

A LARGE DUCT CLEANING contract was recently completed at the Milwaukee county courthouse, a $6¾ million, 20 year old structure which has nearly 18 miles of ventilating and heating ducts in use. Although the operating staff, under the direction of the building superintendent, is constantly on the job to keep the ducts in fairly clean condition, no complete cleaning by professionals appears to have been previously undertaken.

The ducts range in diameter from 6 to 48 in. (the building is two blocks long and one block wide.) While it is a rather simple matter to clean the 2 ft and 4 ft diameter ducts, as a man can crawl into them with brushes and equipment and do a good job, the operation in the smaller ducts presented a difficult problem, as long handled brushes and other cleaning equipment must be used to get all of the sediment out of the smaller ducts. The smallest ducts men risked entering were those 18 in. wide by 10 in. deep. In one case, a workman squeezed himself into a vertical 10 in. duct, without tools — a vacuum cleaner and other tools being handed to him. In another case, a man worked his way in a duct on his stomach, operating a vacuum cleaner tool as he slid along.

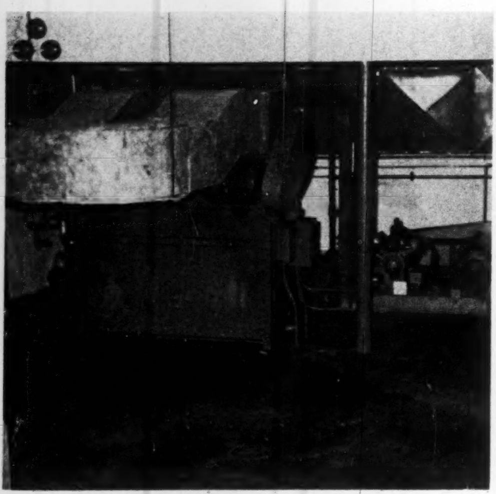
Some of the men got stuck occasionally but were drawn back safely by their mates. It is occasionally necessary to send another man to finish the job, as one workman declared "you swell up somewhat" when you get stuck, probably due to the excitement of being caught. While a given diameter of duct may appear to be large enough to admit a small man, the encrustment of dust and dirt may decrease the diameter at some point in the duct, so that a man cannot squeeze through readily.

. . . . AND THIS ONE was no fun at all for the man inside the duct

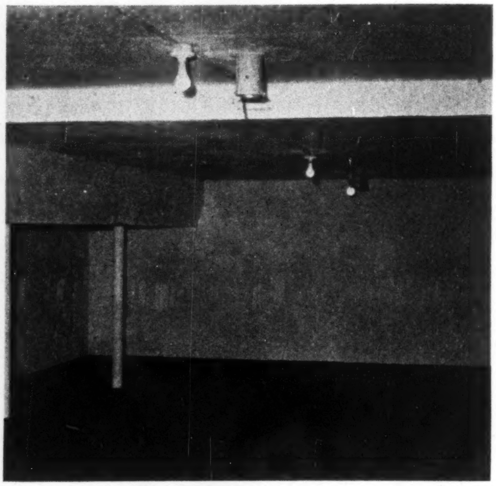
According to John Messmer, superintendent of the courthouse, the duct cleaning contract amounted to approximately $11,000. From five to eight men were kept on the job, the work being done at night as the noise of the high speed vacuum cleaners could not be permitted in the daytime.

In discussing such cleaning jobs in general, a representative of the cleaning contractor declared that air conditioning cleaning jobs have been handled by his firm in many air conditioned Milwaukee buildings. In some instances, he said, the grilles are almost closed up with dirt, as few users make periodic inspection or clean their systems. In some instances, the ducts have been found almost closed up with rags, etc., intended to prevent cooling off rooms in cold weather — especially in restaurants, where exhaust systems are so important for kitchens.—JOHN E. HUBEL.

[The cooperation of the Vulcan Fire Prevention Service, Milwaukee, in preparation of this material is acknowledged. The photos were taken by the Milwaukee Journal.]



AIR CONDITIONING equipment in a machine room maintains the proper temperatures and humidities for protecting valuables in storage



THE CONDITIONED AIR is conveyed to the vaults through insulated sheet metal ducts, is distributed evenly through ceiling diffusers

Storage Vaults Conditioned To Protect Valuables

By Frank Kedenburg, Engineer
Hudson Valley Engineering Co.

The Iron Mountain Atomic Storage Vaults provide 120,000 cu ft of space 300 ft underground in an old mine for the protection of film records, books, papers, paintings, etc. An air conditioning installation maintains temperatures and humidities at the proper values to avoid deterioration of the materials in safekeeping

THE IRON MOUNTAIN Atomic Storage Vaults, built last year and believed to be the first of their kind in the United States, provide safe storage space for valuable paintings, film records, jewelry, books, etc.

The vaulted area — 300 ft underground and over 100 ft from the side of the mountain — is inside an old iron mine shaft. The vaults run the full 650 ft length of the shaft and vary in size from 400 to 15,000 cu ft.

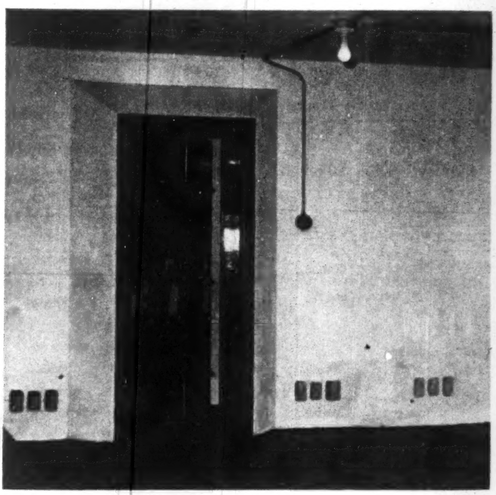
The walls and ceilings are of reinforced concrete and cinder blocks, waterproofed with a membrane and hot tar. The rooms are along the side of a 4 ft wide corridor running the full length of the area. There are groups of rooms on an incline off the corridor to conform with the contour openings in the mine shaft. Each room is an individual safe deposit room with a steel door opened and locked by the security guards.

Why Humidity Is Controlled

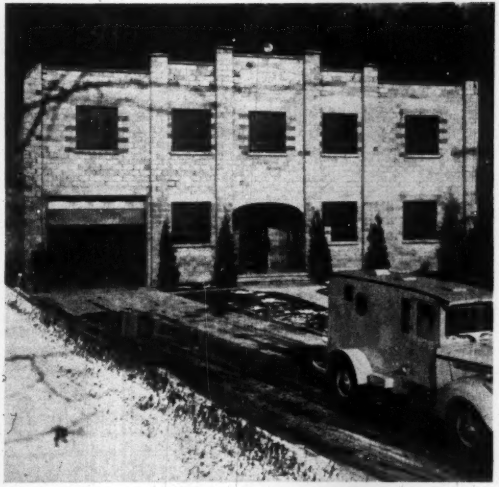
Most records, books, papers, films, leather goods, etc., are hygroscopic and will deteriorate with the wrong temperatures and humidities — low humidities cause them to dry out, rot or crack, and high humidities to stick together or mildew. High humidities also cause metals to corrode and rust. Table 1 shows recommended temperatures and humidities.

Temperature and Humidity Control

Year 'round protection against Nature's varying humidities and temperatures is provided by equipment installed in a machine room



RETURN AIR leaves the storage rooms through vent holes to the corridor, which acts as a return air chamber. The corridor is 4 ft wide



ONE THOUSAND cfm of return air is exhausted into the main vault entrance area to pressurize it, prevent breathing in of humid outside air

adjacent to the entrance to the vaulted area. An insulated sheet metal duct system supplies conditioned air to each room through ceiling type outlets which distribute the air evenly. Each room has vent holes at the floor level to exhaust the moisture-laden air into the corridor, which acts as a return air chamber. A return air duct picks up the return air at the end of the corridor for re-conditioning and recirculation.

A total of 5000 cfm of conditioned air is circulated throughout the space by a fan driven by a 5 hp single phase motor, to maintain 2½ air changes per hr, a storage temperature of 68 to 70 F dry bulb, and 48 to 50 percent relative humidity at all times. One thousand cfm of outside air is supplied to provide a 2 hr ventilation air change, which is adequate for the 10 people that may be occupying the vault area.

The 1000 cfm of outside air at 95 F dry bulb and 75 F wet bulb is mixed with 1000 cfm of return air at 70 F DB and 58½ F WB and is drawn through a six row direct expansion cooling coil, where the temperatures are reduced to 47.5 F DB and 46.5 F WB. This 2000 cfm of cooled air is mixed with 3000 cfm of bypassed return air at 70 F DB and 58½ F WB.

The air is then drawn across a four row hot gas reheat coil to recapture the heat of compression and raise the dry bulb temperature to 70 F.

A single row steam coil, operating with 5 lb of steam pressure, supplies the heat to raise the temperature of the supply air to 120 F dry bulb and with a relative humidity of about 15 percent — which is sufficient to maintain the heat loss to the mountain and pick up humidities in excess of the 50 percent design condition.

7.5 Hp Compressor Is Used

The air conditioning equipment consists of the six row, 5 sq ft face area, finned copper cooling coil, connected to a four cylinder, automatic load leveling, cylinder unloading, "Freon" compressor driven by a 7.5 hp single phase motor; the four row, 9.25 sq ft face area, copper finned hot gas reheat coil which functions to eliminate the use of condenser water during light loads and to complement the heating of the conditioned air to save some of the steam supply; and a water cooled condenser-receiver combination to maintain the compressor efficiency under all load conditions.

TABLE 1—RECOMMENDED conditions for storage

	Relative humidity, percent	Temperatures Summer	Winter
Books and papers	40 to 50	70 to 80 F	70 to 80 F
Films	40 to 60	70 to 80 F	60 to 70 F
Leather goods	50	73 F	73 F
Paintings	50	70 F	70 F
Pharmaceuticals	30 to 50	70 F	70 F

The controls comprise a room temperature control and a humidity controller. The humidity control operates a solenoid valve on the liquid refrigerant line, which in turn starts and stops the compressor. The room temperature controller is paralleled with a low limit heating control which maintains a constant heating supply to the conditioned air.

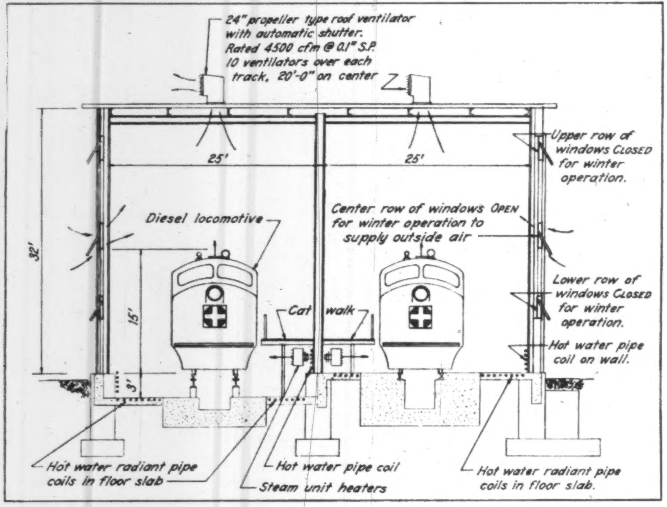
Heat loss to the mountain was calculated on a 50 F ground temperature basis.

One thousand cfm of return air is exhausted into the main vault entrance area to pressurize the entrance and eliminate the possibility of the storage area breathing in the outside warm, humid air while the main vault door and the entrance loading door are open.

The equipment and lighting for the entire storage area can be operated, if commercial power fails, by changing to a standby diesel set.

This installation is the first section of a proposed 400,000 cu ft storage area at other levels in the same mine.

QUESTION OF THE MONTH


24" propeller type roof ventilator with automatic shutter. Rated 4500 cfm @ 0.1" S.P. 10 ventilators over each track, 20'-0" on center
25'
25'
Upper row of windows CLOSED for winter operation.
Diesel locomotive
Center row of windows OPEN for winter operation to supply outside air
32'
15'
3'
Cat walk
Lower row of windows CLOSED for winter operation.
Hot water pipe coil on wall.
Hot water radiant pipe coils in floor slab
Hot water pipe coil
Steam unit heaters
Hot water radiant pipe coils in floor slab.

TEN POWER ROOF VENTILATORS over each track do the job at the Santa Fe's diesel locomotive repair shop at the Corwith yards, Chicago. The unit heaters are used mainly for snow and ice melting and to dry the locomotive running gear.

How Santa Fe Ventilates a Diesel Locomotive Shop

VENTILATION OF A diesel locomotive repair shop offers several problems which are not found in most ventilation jobs. First of all, the diesel engine is not a fixed object in the shop, thus making it difficult to have a positive duct connection to the engine exhaust. Duct systems also tend to interfere with the operation of overhead cranes, which are a necessary part of a shop of this sort.

The Santa Fe railroad recently completed a diesel locomotive repair shop in its Corwith yards, at Chicago. It is believed that a description of its ventilation will be of interest to H.J.B., who asked a question about this problem which was published in the November HPAC. A cross section of the building is shown in the accompanying sketch.

The ventilation of this building is accomplished with a row of 10 power roof ventilators over each track. A supply of outside air is brought into the building through a row of windows along each side which are mounted about 15 ft from the floor line or level with the locomotive exhaust. The fans are rated for 4500 cfm at 0.1 in. static pressure; thus, the exhaust capacity over each track is 45,000 cfm. Each track is long enough (220 ft) to accommodate four diesel engine units. If all four units are running, which is possible but not usual, there would be a total exhaust from the engines of 84,000 cfm at 600 F or 41,200 cfm at 60 F. The ratio of exhaust fan capacity to engine exhaust gases is 1.09 to 1 at the conditions mentioned above.

The method used for heating this structure plays a very important part in the successful operation of the ventilating system. The heating system, as shown in the sketch, is basically a radiant floor slab heated with hot water, supplemented with three hot water horizontal wall pipe coils running the length of the building. The steam unit heaters shown in the center of the building are used mainly for snow and ice melting and to dry the locomotive running gear, and are not intended to offset any of the building heat loss.

The air turbulence at the working level is kept to a minimum to eliminate drafts. For this reason, the ventilating air supply is introduced above head level. Air tending to fall along the walls is warmed by the wall coils. It can be seen from the sketch that the air movement in the building tends to be upward. The exhaust gases from the engines, being very hot, rise rapidly and are drawn out through the exhaust fans with a minimum amount spilling down into the working areas.

The results from this system have

been very satisfactory, affording a diesel repair shop which is comfortable and safe for workmen even during the most severe winter weather.

Plans for this installation were prepared in the office of the Steam Heat and Water Service Engineer under the direction of the Chief Engineer, F. D. Kinnie. — A. W. Johnson, Steam Heat and Water Service Engineer, The Atchison, Topeka and Santa Fe Railway Co.

I'D DISCOURAGE ITS USE

G. B. asked a very interesting question on connecting discharge from traps (page 102, February HPAC). I have come across a number of similar hook-ups, and I do my best to discourage their use.

My principal reason for not liking the hook-up is that it is my opinion that it has the effect of increasing the amount of air in the discharge piping from the condensate pumps. In addition, under some circumstances, it creates noise in the piping. There are also other service problems in connection with such hook-ups.

I suggest that it would add to the diagram by showing the receivers of the condensate pumps, which are generally vented to atmosphere, and it is this venting that I believe is very important. — W. B. P.

"FASCINATING ASPECT" OF ADMINISTRATION

W. M. Petry is right about the various heat losses of a building or group of buildings, in his comments on page 74 of the February HPAC. However, the distribution and boiler plant losses are the concern and the responsibility of the operating organization.

The efforts in fuel conservation intended to be highlighted in my short article in the January issue are the ones which involve cooperation with the users of the building — where heating is perhaps 70 percent of the total expense.

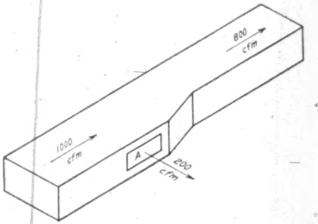
I am delighted that more people are becoming interested in this fascinating aspect of physical plant administration.—Lyman R. Flook, Superintendent of Buildings and Grounds (on leave of absence), University of Chicago.

CAN YOU ANSWER THESE QUESTIONS ON DUCT DESIGN AND AIR FLOW?

If you don't have the answer to one of your problems, chances are someone else does — or can be helpful on part of it. That's the purpose of this "idea exchange" in each issue, where questions on heating, piping and air conditioning are asked and answered.

You are invited to contribute a question for publication, or an answer to a published question. . . . Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Here are some questions on duct design and air flow asked by a mechanical engineer. Can you help him out?



"The duct in the accompanying sketch is designed by the 'equal friction' method, so that the friction loss per foot is constant throughout its length, for the volumes of air flow indicated.

"By 'normal pressure', I mean pressure normal to the face of a grille or other opening provided for letting air out of a duct. This may be the static pressure in the duct, the total pressure in the duct, or the static pressure plus a part of the velocity pressure, depending upon how much of the velocity pressure is utilized in pushing the air out of the opening.

"*QUESTION* 1 — Must opening *A* be of a definite size, for 200 cfm, a variation from which would cause more or less than 200 cfm to flow out of it, and *less* or *more* than 800 cfm to flow in the second section of duct?

"*QUESTION* 2 — Upon the sudden 90 deg change in direction of the 200-cfm-portion of air coming out of the opening, is all of the velocity pressure it had when flowing in the first section of the duct, lost in the shock of the directional change?

"*QUESTION* 3 — Is any of its former velocity pressure recovered so as to increase the pressure behind the opening (normal pressure), as would be the case if the air had been turned by means of an elbow or other turning device?

"*QUESTION* 4 — If any of its former velocity pressure is recovered, what percent (approximately)?

"*QUESTION* 5 — Is the velocity pressure in the air stream, just outside of the opening, equal to the normal pressure inside the opening minus the friction loss through the opening?

"*QUESTION* 6 — Is this friction loss relatively small, or, in other words, is the normal pressure inside almost entirely converted into velocity pressure when the air flows out of the opening?

"*QUESTION* 7 — In manufacturers' grille selection tables, a certain 'pressure required behind the grille' is given for a certain size of grille, a certain volume of air flow through the grille, and a certain throw. Must this pressure, as given in the tables, be the same as that which actually exists in the duct behind the grille (normal to the face of the grille) to get the volume of flow and throw from that particular grille, as shown in the tables?"

ANYTHING CAN HAPPEN . . *(and sometimes does)*

Don't Forget Contraction When Figuring Pipe Expansion

• *We've all had trouble of some kind or another on a heating, piping or air conditioning job — trouble which never should have happened . . . . . but did! Here's your chance to get the incident off your mind, and at the same time help others to avoid the same mistake. We'll keep your name out of it if you prefer. Address your contribution to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

SEVERAL YEARS AGO, a large university woke up to the fact that it was rapidly outgrowing its low pressure steam distribution system and that corrective measures would have to be planned quickly. The superintendent of maintenance asked me to come out and talk it over to determine what should be done.

After a study of the growth of the university and the available land for further expansion, it was decided to run an 8 in. 150 lb steam line in an existing tunnel to the western edge of the campus. The line was to feed back through a pressure reducing station to the low pressure system and also have enough additional capacity to take care of foreseeable growth.

The tunnel had plenty of room and was dry. However, it was hot because of two large low pressure steam mains already in service and lack of ventilation under service conditions—though it could be cooled by blowers when necessary.

The maintenance superintendent was ambitious and chose to go it alone on design and construction rather than to call in outside consulting engineering help. He planned to do the work with his own maintenance crew. He asked me to help him establish anchor points, select the proper device to care for the expansion in the line, and determine the amount of traverse required at each expansion joint station. The job was not complicated and I was delighted to be of service—since a nice order was practically a certainty.

We selected a husky mechanically packed expansion joint with internal and external limit stops and with ample provision for expansion. My recollection is that we allowed at each expansion joint 8 in. traverse, where the maximum possible requirement was not over 6 in.

In due time the order for the expansion joints and some other specialties arrived. When they had been shipped, I promptly forgot the job.

"Line Lying on Tunnel Floor"

About two months after the material was shipped, I was reminded of the job—and how!

I was traveling, and the office caught up with me somewhere with a phone call which came through about 8 p.m. One of the boys in the office read a telegram to me that had been received that day.

The wire was from my friend the maintenance superintendent, and went something like this, "Come at once. Anchors on 8 in. steam line failed. Several hundred feet of line lying on floor of tunnel."

When I recovered from the shock, I checked trains and busses and found that I was stuck until the next day. I got precious little sleep that night, for I lay awake jabbing at my memory for every detail of that line so that I could check and re-check any reason for the disaster.

When I arrived at the university, I looked up my friend. He looked as if he'd been drawn through a knothole. He was sitting on his private tragedy and had thus far managed to keep the story from seeping back to the high brass.

He had a few choice observations to make on my ability as an adviser, and when he got through with me Benedict Arnold was a right guy by comparison.

We finally reached the scene—and, sweating from my friend's remarks and the 120 deg temperature of the tunnel, I took a long, horrified look. Two double expansion joints with anchors and about 500 ft of pipe were dangling half in the air and half on the tunnel floor. The anchors had been bolted through the tunnel wall (4 in. thick reinforced concrete) and secured through steel backing plates on the outer side of the wall. In pulling loose, these anchors had torn a 2 ft chunk of concrete out of the wall at each of the anchor points.

I asked my friend if steam was on the line when it let go. His answer was a profane and emphatic "No!" When things had quieted down a bit, I cautiously asked when it had happened. The answer was that the such-and-such line had let go under test before they ever had a chance to put steam on. After a respectful pause to allow my friend to level off at a lively simmer, I asked him the $64 question: "What did you test with?" There was a long pause and then things really cut loose. I was a spectator at one of the most elaborate displays of mortified cussing that I have ever been privileged to see and hear.

45 Deg Test Water Caused the Trouble

Let us leave my friend to his sorrow and mortification and go on to the explanation of this expensive, humiliating and unnecessary accident.

The tunnel had an ambient temperature of about 120 deg. The expansion joints were furnished with 8 in. traverse at each slip, and my thrifty friend was going to get all the traverse he had bought so he pulled the slips all the way out to the stops to get all the travel coming to him. The power plant had a dandy well with plenty of pure water at 45 deg. Since the 8 in. line started at the power plant, the easiest and most effective test would obviously be a hydrostatic one.

My friend tested his line with 45 deg water when the temperature of the line was at or near 120 deg. He had pulled the expansion joint slips out to the stops in anticipation of steam temperatures. The line contracted—obviously—and there was nothing there to accommodate the contraction. Something had had to give — and it did. — CHARLES W. KIMBROUGH, General Meters & Controls Co.

THE LAW AND YOUR PROFITS

Manufacturing Defects and the Installer's Skill

HEATTER & Co. made arrangements with the Boyla Corp. (the names are fictitious) to use its product in a good-sized job they had undertaken. This arrangement was what is legally known as a "contract of hiring".

When the boilers arrived, Mr. Heatter found them unsuited to the job. He decided to go ahead and use them anyway, believing that with a little extra work they could be adapted to the specified requirements. However, as the installation progressed, it turned out — due to manufacturing defects — that labor and materials expended upon such adaptation amounted to more than $5000 in excess of the customary allowance.

In addition, Heatter found himself out of pocket $650 for a valve change. He was thus over-invested in the job to the tune of some $6000, whereas his commissions (at the out-of-territory rate) came to only $5228.

Having presented his better-than-$11,000 bill, and payment having been refused, Heatter brought an "action under contract of hiring" against the Boyla Corp., and the trial court appointed an official referee to hear and report. After extended hearings, the referee awarded Heatter $11,075, which sum included full commissions and about $5000 for "extra services performed on boiler installations allegedly due to manufacturing defects" therein, plus the cost of changing the valve.

The defendant took the case to the appellate division of the state supreme court. There it transpired that the testimony upon which the referee based his findings was "predicated upon a *conservative guess*" (italics supplied.) There was lack of such itemized statements and specific figures as might otherwise have satisfied the court.

Consequently, the appellate division slashed $5847 from the referee's award and from the judgment against Boyla which the contractor had obtained in the lower court. Not only was Heatter's charge for extra services and for the valve stricken off, but his commissions were tailored down $802.

The moral of this recital is near the surface. Heatter suffered from lack of hour-by-hour (perhaps even day-by-day) specific cost records. In the absence of such records as might have provided foundation for itemized statements, he was forced to depend upon conservative guesses. These — however convincing to a technical referee — failed to satisfy the court.

One may well ask, "Why need Heatter & Co. have gone to such trouble and expense to remedy a manufacturing defect in the boilers — assuming that there was not sufficient time for him to ship them back to the factory and effect a replacement? Was not the manufacturer a top-rated concern that might have been held solvently liable by the building owner for any damages resulting from defective merchandise? After all, was not the Heatter firm a mere agent for Boyla, admittedly acting under a 'hiring agreement'?"

A recent decision in another state disposes of these questions, and at the same time emphasizes the hazards that a contractor faces and against which he is advisedly on his guard. In this second case a defective blower in the heating system was installed by the A. B. Co., in behalf of the C. D. Blower Corp.

As a sequel to the consequent overheating, the building burned down. The owner sued both the installer and the manufacturing corporation. But for the fact that in this case the owner had dealt directly with the manufacturer instead of with the contractor as in the instance of our friend Heatter, the A. B. Co. would have had to share the loss.

In deciding this case, the court took cognizance of the conscientious skill required in the heating business: "Many authorities could be cited to the effect that when a heating system is not properly installed, it becomes a dangerous instrumentality and that a high degree of care is required by those who install them."

Further light is thrown upon the obligation of a heating contractor properly to install and inspect by a decision in yet another state. In this case, a building and contents were destroyed as a result (it was claimed) of a heating system installation improperly done. Evidence showed that the owner had called attention to the fact that the pipes were too close to the wood joists and the installer had said he would "fix it all right".

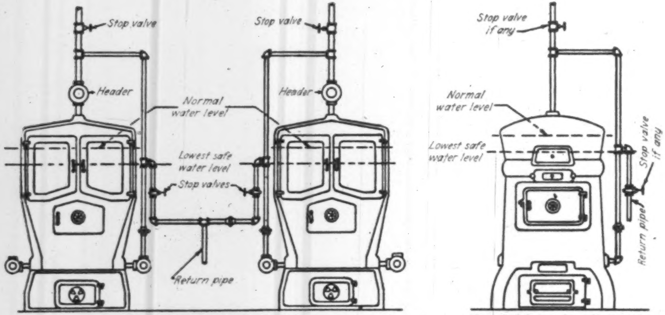
However, the fire when discovered was burning the joists at the criticized point. The court refused to dismiss the charge of negligence against the heating contractor.

In line with the decisions above cited, the appeals court of another state lays down a general rule regarding the duty a seller owes the purchaser of heating equipment and installations: "One who *supplies* such a thing for such use by others" should know that any defect will be "likely to result in injury to its users" and such a one "is liable to *any person* who, using it properly for the purpose for which it is supplied, is injured by its defective condition."

[Note: While this discussion applies to actual cases, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

SAM LEWIS' PAGE



Method of Connecting Two Boilers

Method of Connecting a Single Boiler

CONNECTING TWO or more boilers by means of the Hartford loop is shown at the left, and the use of this water line return connection for a single boiler is shown at the right. (Courtesy The Hartford Steam Boiler Inspection and Insurance Co.)

Using the Hartford Loop To Protect Steam Boilers

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems . . . . . and sometimes on other matters

We recently designed a low pressure steam heating system for a manufacturing plant. An electric motor driven condensate pump was installed and the 1½ in. discharge pipe into the boiler from this pump was connected into a so-called Hartford loop.

The loop connection has been an excellent and generally trouble-free substitute for a swing check valve on the return pipe from a heating system to a boiler. It comprises a pipe from the steam space on the boiler side of the steam stop valve, connected to the boiler below the water line and on the boiler side of any other valve.

The boiler feed pipe enters a tee in the side of this equalizing loop at a level very close below the normal water line of the boiler. If any accident should occur in the wet return piping — such as a leaking gasket or a cracked fitting — the water in the boiler cannot escape below the level of the bottom of the tee in the side of the loop (except as it might boil out). In any event, there would be some time to discover the leak before the boiler would be damaged.

The Hartford loop is safer than a conventional check valve in the return pipe, since check valves can stick open and can leak rather potently. Most check valves will not open unless a differential pressure of perhaps a foot of water is available, since the area of the orifice must be smaller than the area of the disk.

Experienced steamfitters frequently have found innocent-looking check valves that had been installed presumably to safeguard a boiler, but which were criminally guilty in performing this duty because someone had removed the internal disk and had then replaced the cap.

Reverting to the manufacturing plant and the loop connection, our drawing showed a 1½ in. tee in the vertical equalizing loop, with the bottom of the short nipple that entered the side of the tee 2 in. below the normal water level of the boiler. The boiler feed pipe from the condensate pump entered this tee through a manual valve.

The conscientious steamfitter, however, apparently wished to lean over backwards and so he placed the bottom of the 1½ in. side outlet of the tee at a level 4 in. below the alleged water level. He ran the 1½ in. pump discharge pipe close to the boiler room ceiling far above the water level in the boiler, then dropped it to the level of the tee in the equalizing loop through about 8 ft of horizontal piping. This long pipe close below the normal water level could sometimes be wet and sometimes dry, depending on fluctuations in the boiler water level.

Complaint was made of water hammer in the piping between the pump and the boiler.

It is apparent that the long horizontal feed pipe, so close to the boiler water level, couldn't make up its mind whether to be dry or wet. If the boiler foamed, or if the water level was too high, the horizontal pipe could be full of steam or water.

When they drained down the water level, or when they over-filled the boiler, the noise ceased.

There is nothing significant or vitally important as to the sizes of the pipes that form the loop.

The ASHVE Guide suggests that the diameter of the equalizing loop should not be smaller than that of the main condensate return. This is of course an obvious consideration, since otherwise we might be trying to feed water into the boiler through the steam part of the loop.

This is to suggest that to safeguard the boiler, the 2 in. distance between the level of the side of the tee and the normal water level should be maintained. If the 2 in. distance is increased, the water level could fall so low as to permit serious damage to the boiler. The permissible water level variations must of course be gaged to the size of the boiler and to the accuracy with which the water gage glass level was set in relation to the crown sheet and to the other most-vulnerable heat absorbing surfaces.

DATA SHEET

Safety Rules for Pipefitting Maintenance and Construction Work

1. *Authorization for Maintenance Work*

A. No employees other than authorized pipefitters are allowed to make adjustments or repairs, connections or disconnections on distribution piping, pressure regulators or equipment for water, steam or compressed gases including city and propane gas.

B. Pipefitters are not permitted to make repairs to any type of equipment while it is under pressure unless authorized to do so by the Foreman or Superintendent of the Steamfitting Department.

C. Except in an emergency, pipefitters are not permitted to open or close distributing line valves (affecting more than one piece of equipment) without authorization from the Foreman or Superintendent of the Steamfitting Department.

2. *Installation of Piping and Equipment*

A. All piping and equipment installations shall comply with the requirements of applicable codes of the State of Wisconsin. Installations not covered by State Code shall be in conformity with recognized regulations, such as the National Fire Code.

B. Temporary piping or installation work is not permitted except by special permission of the Steamfitting Maintenance Department Superintendent or Foreman.

C. Pipefitters shall not operate any installation until the Steamfitting Department Foreman has inspected the installation and determined the correct operating procedure.

3. *Disconnections and Removal of Piping or Equipment*

A. The supply outlet must be capped or other positive precaution taken when disconnections are made of either temporary or permanent nature.

B. When piping or other equipment is removed, all hangers, brackets, dangerous projecting studs, etc., shall be removed at once.

4. *Hold-off Tags*

A. Whenever repairs are made to piping or equipment, the main supply valve or controlling lever must be closed and a Hold-Off Tag attached. When possible, a lock shall be used in conjunction with the tag.*

5. *Work Performed from Cranes or Near Crane Runways*

A. The following rules are to be observed when work is performed from cranes or near crane runways:

(1) The Production Department General Foreman is to be advised of the location, nature and extent of the work to be performed.

(2) The Production Foreman is to instruct the Head Hitcher to take the crane out of service and to designate the position of the crane for the period of repair operation.

(3) *When production can be interrupted* for the duration of the repair work, each crane on the runway is to be parked at its runway platform, the crane disconnect switch locked in the open position and a Hold-Off Tag attached to the switch. A red flag shall be displayed from each crane. The main feeder switch for the trolley shall then be opened and locked and a Hold-Off Tag attached.

(4) *When production cannot be stopped,* the pipefitter shall notify his Foreman for authorization for the work before proceeding. When such authorization is given, the Foreman or person authorizing the work shall assume charge of the operation and shall observe the following regulations:

(a) Crane stops shall be applied to both crane rails at a point exactly opposite each other to isolate the working area. Red warning flags are to be displayed from each crane stop.

(b) The crane operator of each crane adjacent to the work area shall be notified of the position of the stops, and steps shall be taken to relay this information should the repair operation overlap the shift. It is recommended that a sign calling attention to the blocked runway be prominently placed in each crane cab.

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*For safety in the installation, maintenance, repair, adjustment, or oiling of all power-driven machines and equipment, such equipment shall be shut down and secured in a positive manner to prevent its operation. The following rules apply:

A. The main switch, valve or operation lever shall be placed in the "off" position.

B. A lock shall be placed to secure the disconnection whenever possible. If a lock cannot be used on electrical equipment, an electrician shall remove the fuses from the circuit.

C. A Hold-Off Tag shall be attached to the switch, valve or lever. This tag shall bear the name, department and telephone extension of the employee authorized to perform the maintenance work.

D. When more than one type of work is being done at the same time, the first employee on the job shall lock and tag the equipment. Additional employees shall attach their tag to the switch, valve or operating lever. In no case shall the lock be removed while tags remain on the equipment, unless replaced by the lock of an employee whose tag remains.

E. Outside Contractor's men shall follow this procedure by having the Allis-Chalmers maintenance department supervising the work shut down the equipment. In no case is equipment to be shut down by an Outside Contractor.

(c) When there is a possibility of contact with crane power circuits or other live electrical equipment, the Superintendent of the Electrical Maintenance Department must be consulted for permission to proceed and for protective methods.

(5) The area below the operation is to be barricaded.†

(6) On completion of the repair work, the employee in charge of the work is to make an inspection of the repair area to assure that the crane runway is safe for crane operation. If the work has been done from the crane, the repairman is to be accompanied by the crane operator.

(7) When the inspection is completed, the repairman is to notify the Production Department General Foreman that the work has been completed.

6. Manholes and Similar Openings

A. When a manhole cover is removed, the hole must be properly guarded with substantial guard rails. In aisles, roadways, or other hazardous locations, warning signs indicating the obstruction shall be placed to warn approaching vehicles of the obstruction.

7. Repairs to Pipe Lines, Tanks or Pressure Vessels

A. Under no circumstances are repairs requiring the use of welding torches or other heating tools or drilling, chipping or electric powered tools to be made on pipe lines, tanks or pressure vessels which have contained gases or volatile material without authorization from the Foreman or Superintendent of the Steamfitting Department. Such equipment must be thoroughly drained, vented and purged until it is definitely established that the container is clean and free from flammable material and gases. When this condition is questionable, a check shall be made by the Health and Safety Department before proceeding with the heating operation.

8. Entering Underground Tunnels or Enclosed Spaces

In any confined areas, especially underground installations or tanks, there may be accumulations of gases or vapors from leaks in gas lines, decomposing materials or fire. These gases may be flammable or toxic. The following rules are to be followed:

A. Where the nature of the installation or conditions encountered indicate that gases or vapors may be present, the Health and Safety Department is to be contacted so that atmosphere checks can be made and proper protective equipment supplied when necessary before any personnel enters the area.

B. Where there is no reason to doubt the safety of entering an enclosed space, workmen may enter the area provided a safety belt is worn with a safe line attached and handled by another workman at the entrance to the enclosure.

C. Should definite odors be noticed or unusual sensations such as dizziness or difficulty in breathing be encountered at any time during the operation, all persons are to evacuate the enclosure immediately and notify their Foreman so that tests may be made.

9. Safety Goggles

A. Spectacle-type safety goggles are the minimum eye protection to be worn by maintenance employees at all times.

B. Clear lens cup goggles or a clear face shield over spectacle-type safety goggles must be worn when chipping, grinding, or pouring lead or babbitt.

C. Green lens brazing cup goggles or a dark green face shield over spectacle-type safety goggles must be worn when acetylene cutting, welding, brazing or heating.

D. A helmet or hand shield over spectacle-type safety goggles must be worn when electrical welding is performed.

Excerpted by permission from a booklet entitled Maintenance and Construction Manual, issued by the Allis-Chalmers Mfg. Co.

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†The danger area below any overhead operation must be barricaded. The Maintenance Department Foreman and the Departmental Foreman are jointly responsible to see that the following regulations are observed:

A. White tape or other plainly visible material shall be used to mark off the danger area.

B. Warning signs are to be placed at frequent intervals along the barricade.

C. Where an aisle or passageway is obstructed, the best alternate route is to be plainly designated and marked with detour signs. In some cases, it may be necessary for the Foreman in charge of the department where the work is being done to open a temporary passage in order to avoid excessively long detours.

D. Employees other than the maintenance crew are not permitted to enter the danger area at any time. The Department Foreman will take whatever steps are necessary to prohibit trespassing. Where necessary, the Plant Protection Department shall be notified for traffic direction.

E. In certain instances, it may be advantageous to provide a protective canopy under the work area rather than barricade a floor area. Since the strength required in a protective canopy is dependent on many variable conditions, the approval of the Buildings and Properties Department is required.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Thermal Performance of Frame Walls

By G. O. Handegord*, Ottawa, and N. B. Hutcheon, Saskatoon, Canada**

IN THE STUDY of the thermal performance of the exterior walls of buildings under winter conditions, certain assumptions have been made to permit the application of simple theory based on uni-directional heat flow perpendicular to the wall. This has resulted in an approach to wall analysis from an *overall average* point of view, conditions being assumed to be uniform in the plane of the wall. Little attention has been given to departures from these uniform conditions resulting from the influence of convective heat transfer in walls with air spaces.

Fig. 1 illustrates the possible effects of convection in the air space of a simple wall. Air in the space in contact with the warm side will become heated and will rise, increasing in temperature as it flows upward. Air next to the cold side of the space will lose heat and will fall, becoming progressively cooler at it descends. The circulation of air thus established within the space will result in a vertical variation in air temperature adjacent to the two bounding surfaces which, for purposes of discussion, may be represented by the curve in the figure.

SUMMARY — A preliminary study has been made of the effects of convection in insulated and uninsulated walls containing air spaces. Data are presented which illustrate the vertical variation in temperatures and heat flow rates existing in frame walls, when the insulation is ideally applied, and when openings occur at the top and bottom of insulations installed to form two air spaces.

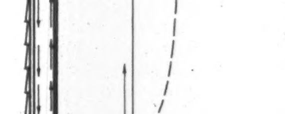

Fig. 1—Convection in air spaces

If it is assumed that ambient air temperatures are uniform over the wall, and that film resistances are constant with height, the rate of heat flow into the wall will be proportional to the air-to-air temperature difference across the inside sheathing. The rate of heat flow into the wall will therefore decrease with height. Similar reasoning may be applied to demonstrate that the rate of heat flow out of the wall, across the outside sheathing, will decrease from top to bottom.

It is more than likely that ambient air temperatures on the warm side of a wall will also increase with height, however, thus tending to produce a still greater variation in air space temperatures. In addition, the film coefficient for natural convection from heated surfaces increases with height up to 2 ft and varies as the 5/4 power of the temperature difference, as shown by Wilkes and Peterson[1]. This variation in film resistance may also contribute to increased variation in the rate of heat flow into the wall.

A still more serious condition may exist in walls insulated with foil curtains or blanket-type insulations where more than one interior air space is formed. When such insulations are installed in practice, it is unlikely that they are always sealed to surrounding structural members, particularly at the top and bottom. Even very small openings will permit

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**Professor of Mechanical Engineering, University of Saskatchewan. Member of ASHVE.

†Presented at the 58th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, St. Louis, Mo., January 1952.

[1] Exponent numerals refer to References.

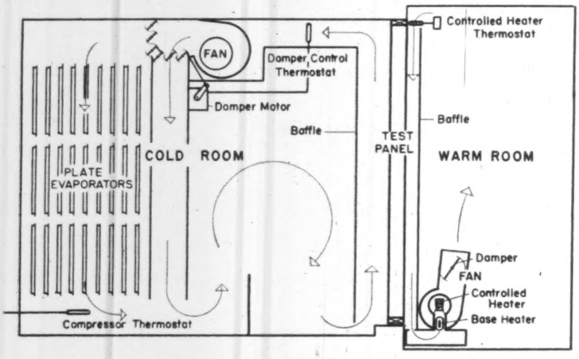


Fig. 2—Cross sectional view of wall panel test apparatus

air circulation between the two spaces since most of the air movement adjacent to a heated or cooled surface takes place within a fraction of an inch. If such a circulation exists, the intermediate membrane serves only as an interceptor of radiant heat, and is essentially bypassed by convection. Depending on the extent to which radiant heat energy is absorbed and transmitted across the spaces, sheathing temperatures will be lower than if no insulation were present and air circulation may be increased. In such cases, an even greater vertical heat flow variation may be experienced.

In addition to these possible effects, the presence of gaps in intermediate membranes will result in an increase in overall heat transfer. This effect has been demonstrated by Rowley et al[2] for blanket type insulations, an increase of 53 percent in overall heat transfer being reported when intentional gaps 1 in. in height were left at the top and bottom of the insulation.

The present project was initiated by the Division of Building Research of the *National Research Council of Canada*, in cooperation with the University of Saskatchewan, to determine the importance of convection effects in standard frame walls with air spaces. The work is being carried out at the Prairie Regional Station of the Division at Saskatoon and this paper presents the results obtained to date.

Test Apparatus

A cross-sectional view of the test apparatus employed is illustrated in Fig. 2. It consists of a cold room-warm room combination in which panels up to 8 ft in height and 7 ft in width may be subjected to steady state heat flow conditions. The refrigeration equipment for the cold room includes a nominal 5-ton, single-stage, water-cooled condensing unit using Freon 22 as the refrigerant. Three banks of nine plate-type evaporators are installed in the cold room, arranged in a unit as shown in Fig. 2. With this equipment, temperatures approaching −40 F may be maintained in the cold room, with a warm room temperature of 70 F.

Forced circulation of air is provided over both sides of the test panel in the direction of natural air movement. This air flow is confined by a baffle on each side so that more uniform velocities over the panel surfaces are provided. On the warm side, fans and heating equipment are mounted on this baffle and the whole assembly is hung from an overhead track so that it may be swung away to provide access to the test panel.

Control of air temperature in the cold room is accomplished by on-off operation of the condensing unit in accordance with the temperature of the air leaving the evaporator, coupled with a modulating by-pass damper arrangement responding to the temperature of the air leaving the panel surface. This control arrangement results in air temperature over the panel being maintained to within 1 F.

Temperature control in the warm room is provided by on-off operation of electric heaters supplemented by a manually-controlled base heater. A sensitive bi-metallic thermo-regulator is used as a controller, operating the heaters through an electronic relay. The base heater is adjusted manually using a variable voltage transformer. Air temperatures are controlled to within ½ F with this arrangement.

Copper-constantan thermocouples are employed for all temperature measurements, using a precision potentiometer. Heatmeters are used to determine heat flow rates, the thermopile emf being recorded with a chart recorder. In order to use this instrument for the purpose, a constant-temperature bias thermocouple is included in the circuit. All thermocouple and heatmeter leads are carried outside the apparatus and connected to a master switchboard.

A track is provided on the baffle covering the warm side of the panel in which a sliding heatmeter support may be moved by an external cord. This support carries the heatmeter by four spring loaded polystyrene rods which press the meter firmly against the wall surface when the baffle is in place. In this way a single heatmeter is employed to traverse the height of the wall.

Test Procedure

A single, basic wall panel 8 ft in height and 5 standard stud spaces in width was used throughout the tests. The various insulations tested were installed only in the three center stud spaces of this panel. Measurements were confined to the center space with the two adjacent spaces serving as guard areas. The 4- by 8-ft plasterboard sheet covering these stud spaces was secured with wood screws so that it could be removed to alter or replace the insulation for the different tests.

In conducting a test on each sample wall, air temperatures on the warm and cold sides of the panel were brought to the desired level and were maintained at this point until constant temperature conditions prevailed throughout the wall. Under these steady state conditions, a heatmeter traverse was made, the meter indications being recorded for a half hour period at each location. A record of this duration was found necessary to provide a good value for the average heat flow, in view of the substantial fluctuations which occurred in readings at some positions.

At the mid-point of the test run, temperatures at approximately 50 locations throughout the wall were measured and recorded.

Air velocities over the panel surfaces were adjusted to reduce vertical air temperature gradients to an acceptable minimum. The velocities under these conditions were approximately 500 fpm on the cold side and 250 fpm on the warm side. These air flow conditions were maintained constant throughout all tests.

Description of Wall Tested

The basic wall panel used throughout consisted of 3/8-in. plasterboard, 2- by 4-in. studding spaced 16 in. on centers (actual dimensions 1½- by 3⅝-in.), 25/32- by 10-in. spruce shiplap sheathing, building paper, and 6- by ½-in. bevel cedar siding. The exterior siding and sheathing and interior plasterboard were secured with wood screws rather than nails, and the siding was given one prime coat and two finish coats of white exterior paint to reduce air infiltration. In addition, the joints between framing and exterior finish were sealed with masking tape. All spaces between the panel and the test opening were packed with wood fiber insulation.

A total of eight different wall constructions was studied. Only four different forms of insulation were used, but further variations were introduced in certain details of application. The various panels are listed as follows:

Panel Number	Description of Insulation
1	Uninsulated.
2	Warm side of air space covered with aluminum foil.
3	Single foil curtain creating two equal air spaces each faced one side with aluminum foil. Curtain sealed to all surrounding framing members.
4	1-in. thick glass-fiber board creating two equal air spaces. Sealed to all framing members.
5	2-in. thick mineral wool batt placed next to plasterboard to form one air space on cold side of insulation.
6	Same as 5, except batt placed against sheathing.
7	Same as 3 with ⅜- by 14½-in. gap at top and bottom.
8	Same as 4 with ⅜- by 14½-in. gap at top and bottom.

The 1-in. glass-fiber board insulation installed in walls 4 and 8 was used to simulate a blanket insulation since its dimensions and its location in the wall were more strictly defined.

Test Results

Figs. 3 to 10, inclusive, represent a graphical presentation of the test results. Each of the figures illustrates the vertical temperature variation at different planes throughout the wall, and the corresponding variation of heat flow into the wall. In all figures, the following numbering system has been used to identify the temperature curves.

Curve Number	Location
1	Warm side air 1 in. from wall surface.
2	Inside surface of plasterboard.
3	Outside surface of plasterboard.
4	Air space, ¾ in. from plasterboard.
5	Air space, ¾ in. from sheathing.
6	Inside surface of sheathing.
7	Cold side air 2 in. from wall surface.

It should be noted that the thermocouples in the air space were placed at geometric locations rather than in accordance with air flow lines. For this reason they did not indicate precisely the variation in temperature of the circulating air. It is possible that the temperature gradients shown for these locations illustrate less severe conditions than actually occurred.

The heat flow rates given were obtained from observed heatmeter millivoltages using the conversion data provided by the manufacturer of the instrument, without further calibration.

Heat Flow into Walls with Air Spaces

In all the walls tested in which the interior finish was exposed to an

Fig. 3—Temperature and heat flow variation in Wall No. 1—uninsulated

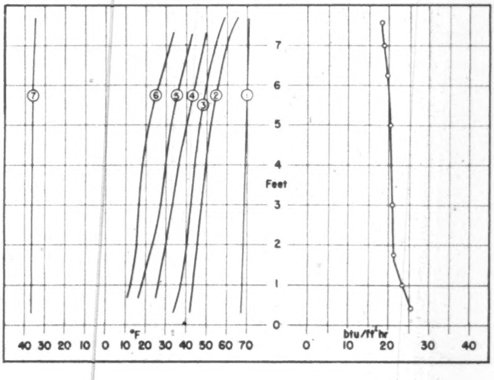
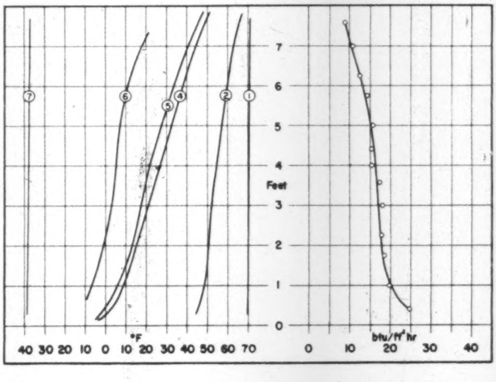


Fig. 4—Temperature and heat flow variation in Wall No. 2—warm side of air space covered with aluminum foil



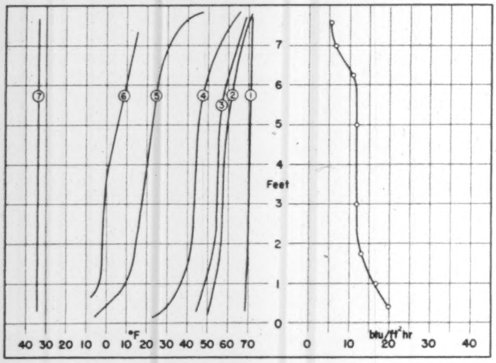


Fig. 5—Temperature and heat flow variation in Wall No. 3—insulated with single foil curtain creating two air spaces. Foil sealed to surrounding framing members

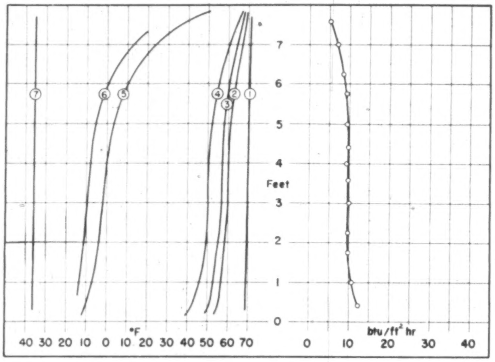


Fig. 6—Temperature and heat flow variation in Wall No. 4—simulated blanket-type insulation. One-inch board, creating two air spaces, sealed to surrounding framing members

air space, the rate of heat flow into the wall decreased with increasing height. This general feature was in keeping with the simple analysis presented previously in the paper. This same variation was exhibited to a lesser degree by Wall No. 5, aside from the increased heat flow rate measured at the 4-ft level. It was found on examination after test, that the sealing strip at the junction of the two 4-ft batt lengths had become detached, and it is likely that some infiltration of air from the outer air space occurred at this discontinuity in the insulation.

Table 1 is presented to facilitate comparison of the various walls as to vertical heat flow variation and overall average values. In preparing this table, the mean rate of heat flow into each wall was calculated from the curves of Figs. 3 to 10 and the heat flow rates at different heights were expressed as percentages of this value. These percentages are shown in the table for the various walls, arranged in order of decreasing magnitude in heat flow variation. It will be noted, however, that the heat flow into the bottom region of Walls No. 6 and 8 was a greater percentage of the average than for Wall No. 3, although the overall variation for these walls was not as extreme. Apparent overall transmittance values were also calculated by dividing the mean heat flow rate by the inside to outside air temperature difference and multiplying by a factor of 1.25 to bring them to closer agreement with accepted values. This factor for heatmeter readings on frame walls has been proposed also by Prof. E. R. Queer in a private communication. It will be noted that the transmittance for the uninsulated frame wall is thus brought very close to the accepted value for such a construction. The transmittances thus found are given in Table 1, together with the corresponding air-to-air temperature differences. Although ambient conditions were not exactly duplicated in all the tests, inside to outside temperature differences were sufficiently close to permit some general comparisons to be made.

Table 1—Percentage Variation in Rate of Heat Flow with Height for Walls with Air Spaces

Wall		Average Heat Flow	Percentage of Average Heat Flow Distance From Bottom of Wall — Inches								Inside — Outside Temperature Difference	Apparent Average Transmittance
Number	Insulation	Btu/ft²hr	6	18	30	42	54	66	78	90	F	Btu/ft²hr F
7	Single Foil Curtain — ⅜-in. gap top and bottom	15.1	229	131	106	90	77	64	53	50	103	0.183
3	Single Foil Curtain — Sealed	12.0	159	117	100	98	98	98	83	46	105	0.143
8	1-in. board — ⅜-in. gap top and bottom	14.5	173	126	107	96	84	77	69	70	98	0.185
6	2-in. batt — next to sheathing	7.9	165	115	106	94	87	83	80	71	102	0.096
2	Reflective surface — warm side of air space	16.2	146	117	110	108	96	91	76	56	108	0.188
4	1-in. board	9.3	130	108	104	105	105	102	89	59	106	0.110
1	Uninsulated	21.1	120	104	101	100	98	96	93	88	103	0.256
5	2-in. batt — next to plasterboard	6.4	109	98	97	103	108	98	97	89	104	0.077

It has been proposed by Prof. F. A. Joy, also in a private communication, that the conversion factors to be applied to heatmeter readings may vary with the resistance of the material between the heatmeter and the first air space encountered in the wall. In view of the doubt which exists on this point it is necessary to consider heatmeter readings carefully, even for comparative purposes, when there has been some change in the arrangement of material on which the heatmeter has been placed. This will apply particularly to the reading obtained for the Wall No. 5 arrangement, in which the mineral wool batt was placed against the back of the plasterboard. The other arrangement which might be questioned is that of Panel No. 2; in all other cases there was a normal air space immediately behind the plasterboard.

The effect of substituting a reflective foil for one of the surfaces bounding an air space in an uninsulated wall resulted in a decrease in the overall heat transferred, but at the same time increased the variation in heat flow from top to bottom. The apparent transmittance at the bottom of the wall, was in fact, increased to a value greater than the average transmittance for the uninsulated wall.

Wall No. 3, representing a wall with a single-foil curtain insulation, exhibited a greater vertical variation in heat flow than all other walls except for Wall No. 7 in which this same insulation was installed with gaps top and bottom. These results, when considered together with the performance of Wall No. 2, suggest that the effects of convection are more pronounced in walls insulated with reflective insulation. This feature is to be expected when it is considered that reflective insulation reduces radiant heat transfer to a minimum so that convective transfer predominates. Walls insulated with such materials will therefore exhibit the characteristics of convective heat transfer to a greater degree.

The effect of gaps at the top and bottom of an intermediate membrane in the air space was to increase the extent of heat flow variation over that for similar walls in which no such openings existed. In the case of the foil curtain insulation, these gaps resulted in an increase of 68 percent in the average heat flow into the wall while for the simulated blanket-type insulation the increase was approximately 30 percent. The average transmittance values for the two walls having improperly sealed insulations were approximately equal, however.

In any consideration of the effects of openings in intermediate membranes in walls, the influence of gaps in exterior or interior coverings is also suggested. It would be expected that openings such as these would have a still greater influence on the thermal characteristics of a wall. For example, in Walls No. 7 and 8, openings at the top and bottom of the exterior sheathing would result in cold outside air being induced into the wall by chimney action and the inside finish would offer the only protection against outside weather. It is not too unlikely that such gaps will exist in some cases since the trend in recent years has been to increase the permeability of outside portions of the wall to reduce the possibility of condensation.

Gaps in interior coverings frequently result in practice from the installation of electrical outlets, and improper sealing around windows and doors. The effects of induced circulation may be even more serious in these cases since the air entering the wall will contain a considerable amount of moisture. These features, although not covered in the experimental work presented, are nevertheless closely associated with convection in walls.

The location of semi-thick batt-type insulation appears to affect both the variation in heat flow with height and the overall average transmittance. From a comparison of the test results for Walls No. 5 and 6, placement of such insulation at the warm side of the air space has advantages from both points of view. The lower average transmittance for Wall No. 5 cannot be readily explained and suggests that more extensive investigation of this phenomenon is required.

Because of the extreme variations in heat flow resulting from convection, transmittance values obtained by application of small heatmeters at single points on a wall may be quite incorrect in the case of walls with air spaces. Full appreciation should be given to these disturbing effects in assessing performance data for hollow walls.

Fig. 7—Temperature and heat flow variation in Wall No. 5—insulated with 2-in. mineral wool batt—air space on cold side of insulation

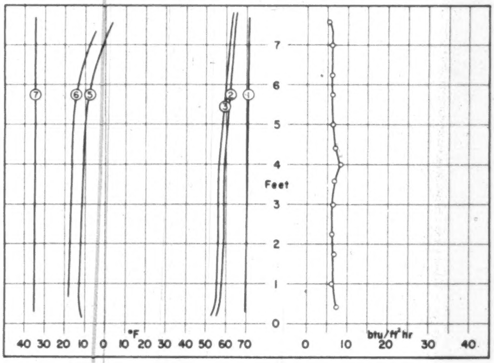
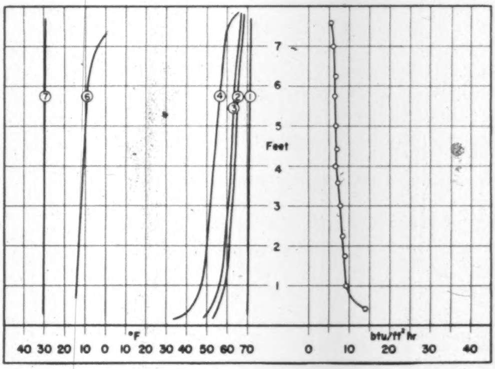


Fig. 8—Temperature and heat flow variation in Wall No. 6—insulated with 2-in. mineral wool batt—air space on warm side of insulation



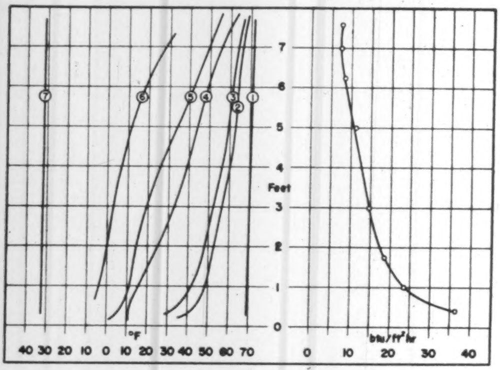


Fig. 9—Temperature and heat flow variation in Wall No. 7—insulated with single foil curtain creating two air spaces—⅜-in. gap top and bottom

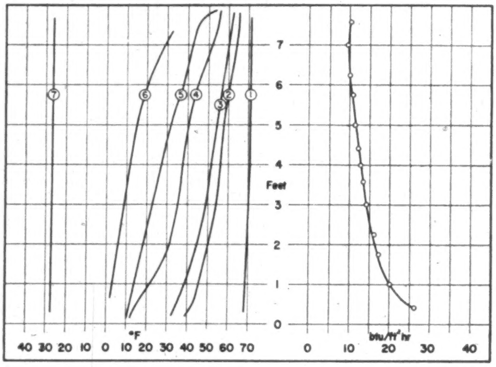


Fig. 10—Temperature and heat flow variation in Wall No. 8—simulated blanket-type insulation—1 in. board creating two air spaces—⅜-in. gap top and bottom

Temperature Distribution in Walls with Air Spaces

The temperature of the inside surfaces of walls is an important feature to be considered in the assessment of wall performance. Such temperatures are closely associated with the problems of surface condensation and dust marking, since both result from a lowering of surface temperature. Usually the temperature of the wall surface is calculated on the basis of simple theory employing the resistance concept. Since this method is based on the assumption of uni-directional heat flow, considerable error results when it is applied to walls with air spaces. Calculation of inside surface temperatures in the usual way, based on a surface film coefficient of 2.7 as given in THE GUIDE* for a velocity of 250 fpm and using the average overall transmittance values from Table 1, provides values in all cases which are higher than those found by test, even for the upper portions of the walls. The variations in temperature drop from air to surface as given by the differences between curves 1 and 2 in Figs. 3 to 10 indicate in a general way the marked deviations in air film conductances with height.

In all cases, inside surface temperatures varied a great deal more than would be expected, temperatures over the lower portions of the walls being consistently low. In the case of Wall No. 7, the effect of improper sealing of the foil curtain resulted in a surface temperature of approximately 35 F at the 6-in. level. Under such conditions, condensation on this area would result if humidities on the warm side exceeded 27 percent at 70 F.

Temperatures of the inside surface of the exterior sheathing in the walls studied also departed widely from the uniform conditions usually assumed, as may be noted in Figs. 3 to 10. The temperatures of this surface are closely associated with the problem of condensation within walls and are, therefore, of considerable importance in any analysis of wall performance.

In general, sheathing temperatures varied with height in a similar manner to temperatures of the inside finish, and it is obvious that wide discrepancies will exist between actual values and values calculated by simple theory.

Conclusions

From the results obtained in this preliminary study of air spaces in walls it is concluded that:

1. The convective action within air spaces in walls has a much greater influence on the temperature distribution and heat flow pattern than is usually assumed.
2. The variations in heat flow and temperature resulting from convection appear to be more pronounced in walls containing reflective insulation than in similar walls having normal surfaces.
3. Improper sealing of blanket-type insulation, or reflective-curtain insulation, installed so as to create multiple air spaces, may result in an increase in both vertical heat flow variation and in overall transmittance.
4. Presently accepted theory based on the assumption of uni-directional heat flow is entirely inadequate for calculation of temperatures in hollow walls.
5. The use of small heat-flow meters to evaluate the overall transmittance of walls may lead to erroneous results unless a complete vertical traverse is taken.

Acknowledgments

The authors wish to express their appreciation for the assistance given them by Mr. K. R. Solvason, Assistant Research Officer of the National Research Council, in various phases of the work.

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*HEATING, VENTILATING, AIR CONDITIONING GUIDE, published by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13, N.Y.

The ASHVE Environment Laboratory

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SUMMARY — The new Environment Laboratory located in the ASHVE Research Laboratory, Cleveland, will provide facilities for the study of panel heating performance and also for further study of human reactions to environment involving various combinations of temperatures of air and interior wall surfaces. Temperatures of all surfaces or portions of them may be varied at will to simulate field operating conditions. Ceiling height is also adjustable. Ventilation may be varied as desired. For comparative studies, the large room may be divided into two smaller rooms.

To get the true background for the new research facilities recently completed at the Society's Research Laboratory in Cleveland, and officially inaugurated on November 1 and 2, 1951, as *The Environment Laboratory*, one should look back into the 1927 Transactions[□] of the Society, in which the following statements appear:

> While cooling for human comfort has been practiced in many instances for a great many years, the relative effect of the three qualities of the air which govern one's feeling of warmth was not known until recently. At the time the Research Laboratory of the American Society of Heating and Ventilating Engineers was established, little was definitely known concerning the relative effect of various combinations of temperature, humidity, and air motion on one's feeling of warmth. A number of persons were interested in the problem prior to this time and considerable data were collected, but without facilities for independently controlling the three variables, it was difficult to obtain general, consistent results.
>
> Upon the organization of the Research Laboratory, this problem was one of the first to receive attention. With the aid of two rooms in each of which all three factors could be independently controlled, the Research Laboratory of the American Society of Heating and Ventilating Engineers, in cooperation with the U.S. Bureau of Mines and the U.S. Public Health Service, has been able to determine the exact relationship between these three factors and comfort for most conditions of human activity. . . .

The two rooms first mentioned were used almost continuously from 1926 to 1942 and though many other organizations subsequently built far more elaborately equipped *psychrometric rooms* or *climatic chambers*, the original rooms, with certain slight modifications, served the Society well. They also served in the national interest, for both before and during World War II important studies were made in these rooms for the Bureau of Ships, U.S. Navy Department.

When the Society's Research Laboratory was moved from Pittsburgh to Cleveland in 1943 it was, of course, not possible to move these rooms. Even most of the equipment used to condition the rooms was considered as somewhat out of date, and not worth the cost of removal. In the first two years in Cleveland (1943-1945), when the laboratory occupied rented space on a short lease, construction of this type of facility could not be justified.

However, soon after the Society purchased the property where its Laboratory is now located, the Committee on Research began to explore the possibility of constructing facilities suitable for studies on sensory and physiological reactions to the environment and for other studies for which a controlled environment was desirable or essential. The Committee also asked a number of the Technical

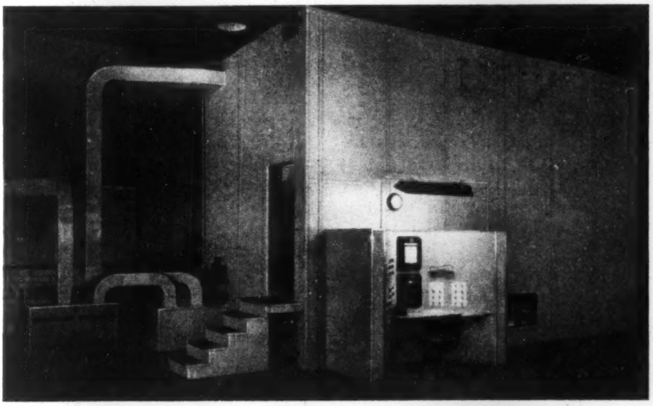

Fig. 1—General view of exterior of Environment Laboratory

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[□] ASHVE Research Report No. 769 — Practical Application of Temperature, Humidity and Air Motion Data to Air Conditioning Problems, by F. C. Houghten, W. W. Teague, and W. E. Miller (ASHVE Transactions, Vol. 33, 1927, p. 152.)

Presented at the 58th Annual Meeting of The American Society of Heating and Ventilating Engineers, St. Louis, Mo., January 1952.

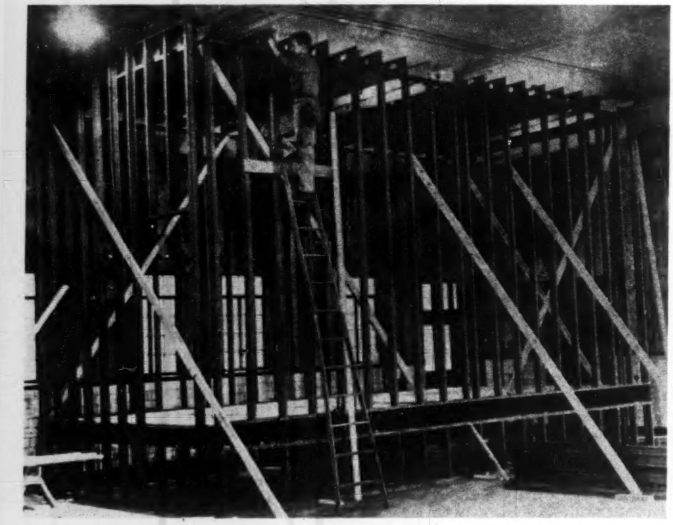

Fig. 2—Light steel framework of Environment Laboratory during construction

Advisory Committees for recommendations on the type of facilities to be provided. In 1944 a careful study was made of many of the rooms erected in various places during the previous 15 years. After personal visits, and an examination of the plans and equipment for these rooms, the general plan of rooms which might serve the Society's interests began to develop. Preliminary cost estimates were made and it was soon realized that the construction and equipping of the rooms was likely to be a major undertaking if they were to be built so as to serve a wide variety of interests over a long period.

As industry support of Society research increased, it became possible to begin setting aside certain funds in reserve against the time when they would be needed for this construction.

Research Program in Panel Heating and Cooling

Early in 1947, as the result of a conference held in Cleveland, the Society undertook to carry on an extensive and long-range research program on panel heating and cooling. The overall program was divided into four parts, each of which was assigned to a sub-committee or group. One part of this program was concerned with studies of *heat transfer between the panel and the space*, another with *comfort conditions in panel heating*.

The first of these was entrusted to the *Group B* sub-committee of the TAC on Panel Heating and Cooling, under the chairmanship of John W. James, Chicago. At its first meeting this committee approved a program which called for the building of at least one test room in which the temperatures of all the enclosing surfaces could be controlled over a fairly wide range. The design submitted at that time by the Laboratory staff called for a room having inside dimensions of approximately 12 ft by 18 ft with a ceiling height of 9 ft.

During the months following the submission of the first design, further studies were made of design features, and consideration was given to recommendations made by other technical advisory committees — especially those of the TAC on Sensations of Comfort (C. S. Leopold, Philadelphia, chairman) to which, in addition to the programs developed by the committee itself, had been entrusted the responsibility for the studies on *comfort conditions in panel heating* (*Group C*).

Design Suggestions

The main recommendations of this technical advisory committee, which were later incorporated into the present design, were:

1. That the overall size be increased to make it possible, later, to divide the space into two rooms each 12 ft by 12 ft inside.
2. That the ceiling in each half of the room be made adjustable in height from about 6 ft 4 in. to about 15 ft, or as high as structural limitations within the main laboratory would permit.

The Committee also suggested that after the completion of the panel heating studies, in which only nominal quantities of ventilation air would be needed, it would be necessary to make provision for large quantities of conditioned air to be distributed by perforated ceiling panels, ceiling diffusers, side wall and other types of outlets.

Present Design

The overall dimensions of the space, and the idea of an adjustable ceiling, were settled late in 1949 and the steel framework ordered and delivered early in 1950. *Group B*, outlining the desired specifications for the room, had asked that the room be so designed and constructed as to make it possible to simulate inside surface temperatures that might prevail in practice, with normal types of building construction, at outdoor temperatures down to zero Fahrenheit. Calculations showed that this would require that simulated wall and single glass surfaces be capable of being maintained at temperatures down to approximately 40 and 20 F, respectively.

It was also suggested that the design provide for a good deal of flexibility in simulated wall and glass areas, both as to location and relative area, and that provision be made to cool the equivalent of one entire long wall of the room down to 20 F.

Other decisions that influenced the design were:

1. That equipment be provided to heat either the entire ceiling, or the entire

floor, or both, to a temperature of at least 150 F.

2. That provision be made for cooling the entire floor, or the entire ceiling to 40 F.

3. That provision be made to simulate infiltration up to two air changes per hour for the whole room, *i.e.* approximately 7200 cu ft per hour, and to cool this air down to zero Fahrenheit.

It was not until the middle of 1950 that final decisions were made on the methods to be used for obtaining the heated or cooled surfaces, or both, throughout the space, and on the means to be provided to measure heat flow between these surfaces and the space. These decisions were made with the guidance of the Steering Committee of the TAC on Panel Heating and Cooling (P. B. Gordon, New York, chairman) on which all four groups, *A*, *B*, *C*, and *D* are represented.

As might be expected, a number of problems arose during the completion of the detailed design drawings and the procurement of the various components of the finished structure. Some of these required considerable study and experimentation before satisfactory solutions were found, especially since, so far as the Laboratory staff know, there is no other test facility built today that includes some of the special features that this facility has.

Design Details

To provide fairly complete information on this room for the use of others interested in this type of test facility, and as a reference for later papers which will cover the results of tests made in the room or rooms, there follow details of (1) the framework, vapor barrier and means of adjusting the ceiling height; (2) the panels to provide heated and cooled surfaces; (3) the fluid circuits for these panels; (4) means for dehumidifying and introducing infiltration air; (5) instrumentation of the room: (*a*) surface thermocouples (*b*) heat flow meters (*c*) air temperature measurements (*d*) air motion measurements (*e*) measurement of radiation.

Also discussed are the present ideas on how the room can be made into a true *environment laboratory*. In its present state it can hardly be so designated; it is more truly a *calorimeter room* and was so designated in the early plans. The name *Environment Laboratory*, adopted by the Committee on Research in 1951, was intended to indicate the full extent of the use to which these rooms will ultimately be put.

Framework, Vapor Barrier and Adjustable Ceiling

The Environment Laboratory (Fig. 1) is located in the upper floor of the Research Laboratory where there is a clear ceiling height of 17 ft 11 in. The framework consists of lightweight steel members (3-5/8 in. studding and 9 in. floor and ceiling joists) installed on 16 in. centers. A photograph taken during the erection (Fig. 2) shows the steel framework with the rough floor in place.

The floor of the room is located 3 ft above the main Research Laboratory floor, which provides a crawl space for the installation of pipes, ducts, and wiring. The fixed ceiling joists shown in Fig. 2 are about 14 in. from the laboratory ceiling. This space was considered essential for the installation of the fixed ceiling and to leave room for future ducts and other services. The provision of this space and the crawl space limited the available ceiling height in the room to a maximum of 12 ft. Provision was also made in the framing of the room for the installation of a partition to divide the space into two 12 ft by 12 ft rooms, at a later date.

Wood strips 1-1/8 in. x 3 in. were fastened to the outside of the studding to provide attachment for the outer shell of the room. A vapor barrier, consisting of kraft paper between two layers of aluminum foil, was then placed over the entire framework of the walls and roof. All vertical laps on the side walls and longitudinal laps on the roof were made at the studs or joists, and every precaution was taken to obtain a vapor-tight envelope. The vapor seal may be seen between the studs in Fig. 3. Plywood (3/4 in.) primed on both sides with two coats of aluminum paint was fastened over the vapor seal on the walls and ceiling to form the outer shell of the room.

The floor of the crawl space consists of 24 gage galvanized sheets laid on the wood floor of the upper laboratory. All seams between the sheets are soldered, and the edges of the sheets around the perimeter of the room are turned up approximately 1-1/2 in. In addition to serving as a drip pan in case of pipe leakage, this arrangement forms a very effective vapor seal at the bottom of the enclosure.

To obtain the variable ceiling

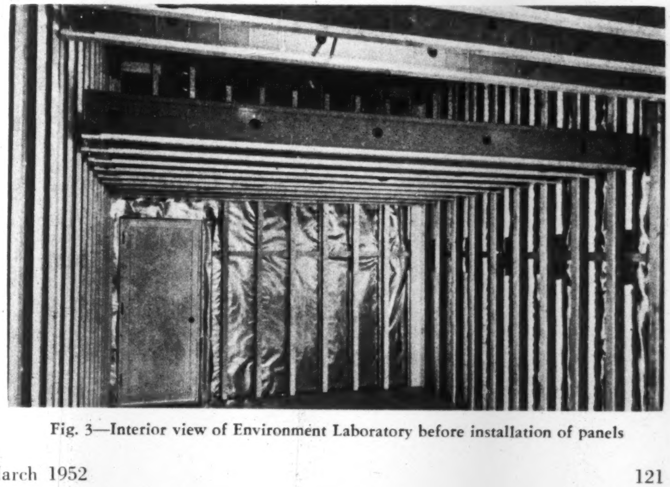

Fig. 3—Interior view of Environment Laboratory before installation of panels

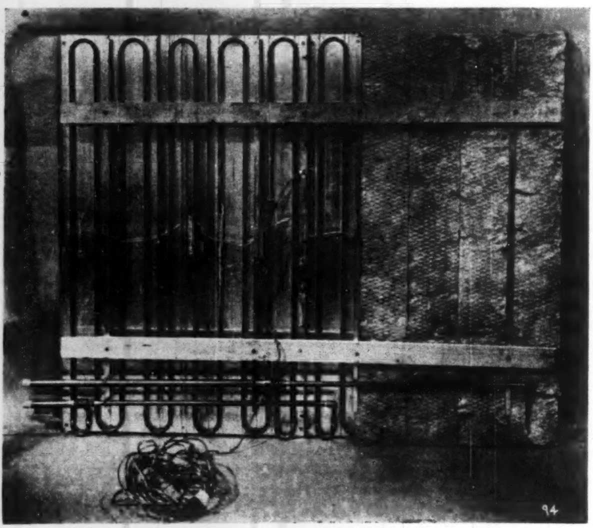

Fig. 4—Rear view of one of aluminum panels

height requested by the TAC on Sensations of Comfort, a second, movable, ceiling was constructed on a framework of angle iron and 9 in. steel joists. This was built in two halves, so that when the room is divided the height of the ceiling in either room may be adjusted, independently of the other. The framing for the two sections of the ceiling may be seen hanging at different heights in Fig. 3.

Each half of the adjustable ceiling is suspended on steel tiller ropes from 2 in. pipes, which pass through holes in the fixed roof joists. The pipes are mounted in maple bearings, and may be turned by means of worm and gear assemblies mounted on the exterior of the structure. As the pipe is turned, the ropes wind or unwind around the pipe, thus raising or lowering the ceiling. One of the gear assemblies may be seen at the top near corner of the room in Fig. 1. One of the long awning cranks used to operate the hoisting mechanism may be seen hanging at the other end of the front wall. Hoisting mechanism for the other half of the ceiling is at the other end of the room.

Heating and Cooling Panels

Even after it had been decided that the interior surfaces of the room should consist of metal panels, the design of the panels presented many problems. Some of the more important requirements which had to be met were:

1. Panels should be light in weight to facilitate installation and reduce floor loading.
2. The thermal conductivity should be high to assure a reasonably uniform surface temperature.
3. Panels should have low heat capacity to permit rapid change of conditions.
4. At least that portion of the panel in contact with the heating or cooling fluid should be of a material which would not present a serious corrosion problem when used in a system containing copper, brass, and galvanized steel.
5. The finished surface should present a pleasing appearance, since the rooms were to be used later for studies on sensory reactions to the environment.
6. The panels should be readily obtainable at reasonable cost.

Since it was planned to paint or paper the panel surfaces, the emissivity of the panels, as furnished, was not considered important.

The type of panel judged to most nearly fulfill all these requirements was one described in a recent paper by Charles S. Leopold[1]. The panels consist of aluminum extrusions, 6 in. or 12 in. wide and 1/16 in. thick, stiffened by ribs on the back. Wider panels, in any multiple of 6 in., can be made by spot welding and/or bolting the standard widths together. The back view of a 4-ft square panel is shown in Fig. 4. On the back of the panel there are grooves or troughs 3 in. on centers into which ½ in. O.D. copper tubing is fitted. After the tubing is in place, the sides of the grooves are pressed against and over the tubing, thus clamping it firmly in place. These tubes carry the heating or cooling liquids.

Since it is essential that the temperature of each panel be held reasonably constant over its entire area, the fluid flow rates in the panels have to be much higher than are required in the average panel heating or cooling installation. To minimize pressure losses, the larger panels were constructed with two separate circuits, connected in parallel. These may be seen in the left half of Fig. 4. The right half of Fig. 4 shows a similar panel with insulation in place over the coils, and with parallel piping connections completed.

The length of circuits on the various panels varies considerably. The pressure loss through each panel circuit was determined, and properly sized orifices were installed in the shorter ones, to assure equal loss in all panel circuits when each was supplied with an equal quantity of water *per square foot of panel area.* This step was taken to make sure that each panel would receive its proportionate share of the liquid being circulated through a number of panels connected in parallel.

The arrangement of panels on the various room surfaces is shown in Fig. 5. Table 1 gives the size and circuit arrangement of all panels. The panel arrangement and sizes were carefully chosen to provide maximum flexibility in selecting typical combinations of simulated glass and wall areas for various ceiling heights.

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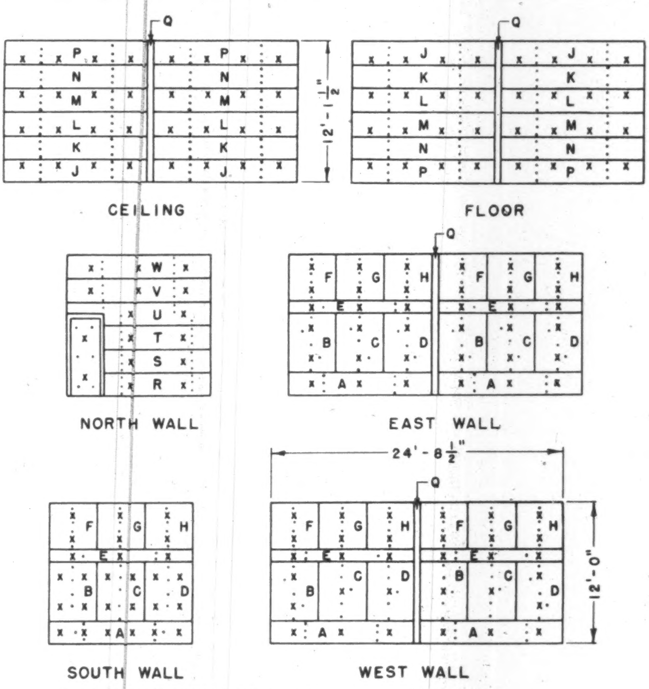
[1] Exponent numerals refer to References.



• = Copper-constantan thermocouples   x = Heat meters

Fig. 5—Panel arrangement and thermocouple and heatmeter locations in Environment Laboratory

Table 1—Size and Circuit Arrangement of Panels

Panel Designation	Panel Dimensions, Inches	Tube Circuit
A, J, K, L, M, N, P, U, V, W	144x24	Parallel
B, C, D,	60x48	Parallel
E	144x12	Single
F, G, H,	48x48	Parallel
Q	144x6	Single
R, S, T,	108x24	Parallel

The 6-in. wide panels located at the center of the floor, ceiling, and long walls, constitute a part of the provisions for dividing the room at some future time. These panels can be removed later to provide space for the partition.

Fluid Circuits

The tanks, heaters, coolers, pumps, and other equipment necessary for conditioning and circulating liquids through the various wall, floor and ceiling panels are located on the lower floor of the Research Laboratory directly below the room. A general view of this equipment and the piping, before insulation was applied, is shown in Fig. 6.

Since it is necessary to cool some of the panels below the freezing point of water, the entire system contains a 22 percent by weight, aqueous solution of ethylene glycol. A corrosion inhibitor, prepared in accordance with the best information available, was added to the solution.

Liquid for cooling the panels is chilled in a shell and tube type heat exchanger by a 15-hp "Freon" F-12 compressor. Chilled liquid is stored in a 300-gal tank and is circulated through the tank and heat exchanger by a pump which also provides adequate mixing in the tank. The temperature of the liquid in the tank is controlled by a pneumatic thermostat which, by means of a cylinder unloading device, can operate the compressor at any of five capacity steps, or can stop it completely.

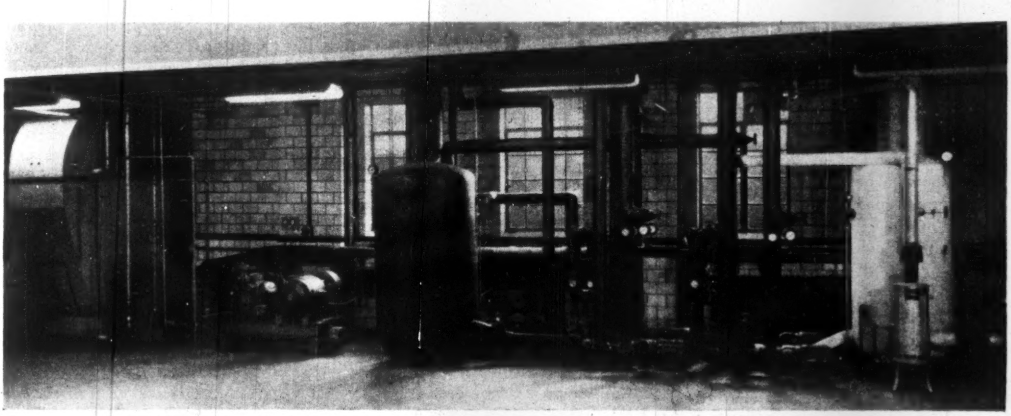


Fig. 6—General view of equipment for conditioning and circulating heated and chilled liquid to the panels

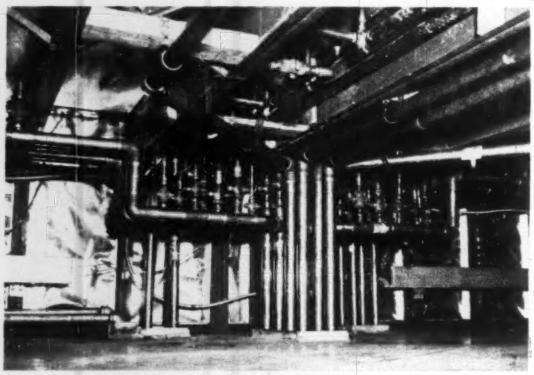


Fig. 7—View of piping in crawl space showing risers, run outs and valves

Liquid for the warm panels is heated by a gas-fired water heater, and stored in a 220-gal tank. A pump provides positive circulation through the tank and heater, and assures good mixing in the tank. It is believed that adequate control of the hot water temperature can be obtained by manual adjustment of the gas supply, but provisions have been made for installing automatic control if it is found to be desirable.

Four centrifugal pumps and four piping circuits are arranged to supply liquid at the desired conditions to the panels in the Environment Laboratory. All of the lines in the lower laboratory level are of threaded galvanized pipe and fittings (Fig. 6). The mains and branches in the crawl space, and the risers in the walls, are of type L copper tubing with sweated joints. Piping in the crawl space is so arranged that when the space is divided into two rooms, the circuits to each room will be independent of one another. Fig. 7 shows a portion of the piping in the crawl space.

Each of the circuits is briefly described as follows:

Simulated Cold Wall Circuit. The pump for this circuit has a capacity of 60 gpm against an 85-ft head, and takes its suction from the chilled liquid tank. All of the panels on all four walls are connected to this circuit, and the connection to each panel is valved in the crawl space. Temperature control in this circuit is obtained by mixing some of the return liquid from the circuit with the cold liquid from the storage tank. At the present time this mixing is being controlled manually, but provisions have been made in the piping system for the installation of a thermostatically controlled mixing valve, if such should prove desirable.

Simulated Glass Circuit. Liquid to the simulated glass surface is supplied by a pump having a capacity of 45 gpm at an 85-ft head. All of the panels on the north, east, and south walls, and the B, C, and D panels on the west wall (see Fig. 5) are connected to this circuit, and the connection to each panel is valved. If the temperature of the chilled liquid in the tank is being controlled at the desired simulated glass temperature, the pump can take all of its suction directly from the tank. If the tank temperature is too low, the liquid temperature in this circuit can be controlled by mixing as described above for the cold wall circuit.

Floor and Ceiling Circuits. Separate pumps are provided for the floor circuit and ceiling circuit; each has a capacity of 45 gpm at a 60-ft head and each can take suction from either the cold or the hot liquid tank. Close control of the temperature of the liquid in each circuit can be obtained by mixing. The connections to the floor panels are valved in the crawl space and the ceiling panels are individually valved above the ceiling.

Connections from the risers to the ceiling panel headers are made with hose to permit the ceiling to be raised or lowered as desired.

Descriptions of the various circuits have been given to illustrate the wide range of surface temperature conditions which may be set up. In considering the many possibilities, it should be remembered that by closing the valves to individual panels, any surface or any part of any surface may be made neutral, that is, it will be neither heated nor cooled.

The maximum cooling load provided is the equivalent of cooling one entire long wall to approximately 20 F. Within the limits of this cooling capacity, many combinations of simulated glass and cold wall areas are obtainable on one, two, three or four walls. In combination with the various wall conditions, the floor or ceiling, or any part of one or the other, may be cooled. In such a combination, all of the simulated glass areas would be at one temperature, the simulated cold wall surfaces at another, and the floor or ceiling could be maintained at still another temperature lower than that of the room air. Further combinations could be obtained by varying the ceiling height.

Heating may be obtained from all or any part of the floor, the ceiling, or both. It is not possible, however, to cool one part of the floor and heat the other part simultaneously, nor is it possible to do this with the two halves of the ceiling.

Dehumidification and Infiltration Air Circuits

Air must be supplied to the Environment Laboratory for two distinct purposes. *First,* to simulate the effect of infiltration occurring in normal enclosures, it is necessary to introduce air at whatever temperature is chosen as the *outside temperature* for any particular set of operating conditions. Provision was made to introduce the equivalent of two air changes per hour with a 12-ft ceiling and three air changes per hour with an 8-ft ceiling. *Second,* to prevent condensation on the cold pipes and panel surfaces, it is essential that enough dehumidified air be introduced into the space to hold the dewpoint of the air below the lowest surface temperature at all times. Fig. 8 shows the arrangement of dehumidifier, coils, fan, condensing unit and connecting ducts installed to supply the infiltration and dehumidification air.

Approximately 800 cu ft of air per minute is taken through a duct from

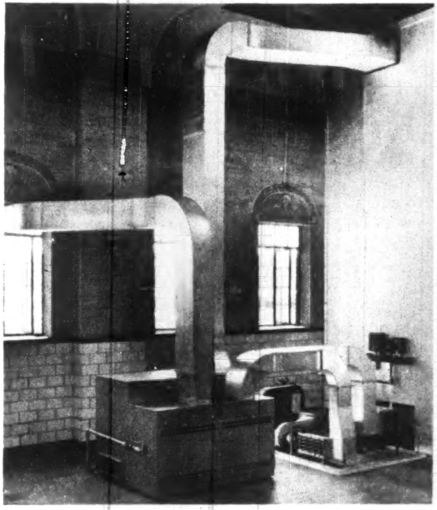


Fig. 8—Arrangement of dehumidifier coils, condensing unit and connecting ducts to supply infiltration and dehumidification air

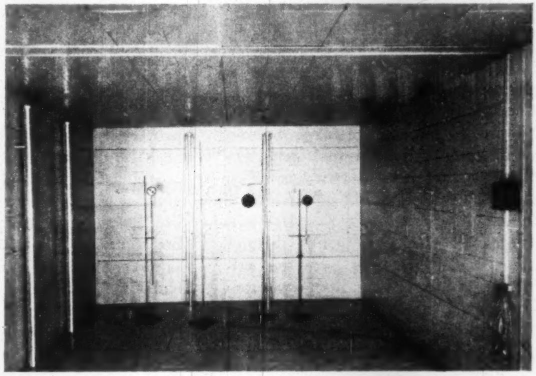


Fig. 9—Interior view of room showing standpipes for infiltration air and instruments for measuring air motion and mean radiant temperature

the space above the adjustable ceiling and passed through a sorption type dehumidifier. The greater part of this air is passed through a finned coil, where it is cooled to approximately 70 F by chilled glycol solution from the tank in the basement. It is then discharged into the crawl space and finds its way up through the stud spaces to the space above the adjustable ceiling. Thus, all of the spaces containing piping or facing the back of the panels, including the crawl space, the spaces back of the wall panels, and that over the ceiling, have dehumidified air circulating through them.

The remainder of the dehumidified air, up to approximately 130 cfm, first passes through a precooling coil where it is cooled by glycol solution. It is then picked up by a booster fan and discharged through a direct expansion coil where it is cooled to any desired final temperature down to zero F. From this coil it is conveyed through a duct located in the crawl space and is finally discharged through 150 holes (1/8 in.) in each of six standpipes located along the east and south walls. These standpipes may be seen in Fig. 9. Shields were placed between the pipes and the panel to prevent the air jets from impinging on the panel surface. The air is allowed to escape from the room through cracks between the panels, and eventually finds its way back to the dehumidifier. The final temperature of the infiltration air is controlled by allowing the condensing unit to operate continuously, and regulating the temperature of the air entering the direct expansion coil by modulating the flow of glycol solution to the precooling coil.

A sharp edged orifice is provided in the main duct to measure the quantity of infiltration air supplied. Blast gates are installed in each standpipe to control the air flow.

Instrumentation

The Environment Laboratory has been provided with instrumentation to measure not only the temperatures of, and the rates of heat exchange at, all surfaces of the room, but also all factors which affect heat exchange. In addition, instrumentation has been provided to measure objectively those factors which are related to human comfort. It is anticipated that other instruments will be developed during the course of the experimental work.

With few exceptions the sensing elements of all the instruments are of the thermocouple type. The lead wires are brought out to indicating and recording electronic-type potentiometers through a battery of selector switches. Both switches and potentiometers are arranged on a console type panel for convenient use by a single operator. (Fig. 10 shows a view of the rear of the console, the front of which is shown in Fig. 11.)

Surface Temperatures

Surface temperatures of the 74 panels and the door are measured by approximately 400 thermocouples of 26-gage copper-constantan wires. Each couple was installed in a 1/32-in. deep groove cut into the back of the panel. The junctions were made by flattening the ends of the wires, lapping the joint, and soldering. The junction and about 2 in. of lead wire were cemented into the groove with a porcelain-type cement. A strip of linen cloth was placed between the wire and the bottom of the groove to insure electrical insulation.

From each wall panel lead wires of equal length are carried in plastic tubing and connected to two terminal strips, where they are connected in parallel. Each pair of terminal strips in turn is connected to a selector switch. Thermocouples on each of the floor and ceiling panels are paralleled at the respective panels; the pair of lead wires from each panel is connected directly to a selector switch.

Each of the six room surfaces is provided with a metal sub-panel which carries the terminal strips and the necessary selector switches. These are mounted on the back surfaces of the console panel (see Fig. 10) with the switch shafts projecting through the panels. In this way the sub-panels could be handled separately for wiring and may be removed for changes or repairs, if required. Each sub-panel is enclosed by a removable housing of plywood, covered inside and out with aluminum foil. This provides dust protection and, in some degree, a region of uniform temperature. All selector switches are of the rotary enclosed-contact type.

Each selector switch is connected to a master selector switch, which is in turn connected to an electronic indicating potentiometer, mounted in the center section of the console. This instrument (Fig. 11) is provided with two circuits — one for direct reading of temperatures through a cold junction compensator, the second for reading millivolts. Scale range is −1.0 to +4.0 millivolts.

In addition, rotary switches are provided so that the thermocouples of a limited number of room panel combinations can be paralleled to give a single temperature reading. For example, if all eight panels of the south wall are being held at the same temperature, a single reading will average their temperatures. Or if three panels are held colder than the balance of the wall, to simulate windows, the temperatures of these three can be averaged and those of the remainder can be averaged separately. Temperatures of individual panels can be read at will by rotating the paralleling switch to the proper position.

As an added precaution against temperature differences in two parts of a selector switch, each constantan wire is soldered to a copper wire which leads to the switch terminal. Likewise the common constantan lead wire from the switch is connected to the switch through a copper wire. When this junction, and the others so formed, are placed inside a metal sheath, the possibility of developing stray thermal emfs is avoided. The wiring which connects selector and paralleling switches is entirely of copper, which was found to develop substantially no emf with the switch contacts, in the presence of a temperature gradient across the switch.

Heat Flow Meters

Heat exchange between each room surface and its environment is measured by 175 heat flow meters, each 11-½ in. square, of the type described by Benzinger[2]. These meters consist of a thermal resistance layer of 0.020-in. thick cellulose acetate and series-connected copper-constantan thermo-junctions woven in and out between strips of the plastic. In this construction, the thermo-junctions are made of strips of copper constantan foil, 0.002 in. in thickness, butt welded. By cutting out a notch of constantan on one side of the foil and a notch of copper farther along on the opposite side, a series of large-area junctions are formed. The assembly of foil and plastic strips is then placed in a sandwich of anodized aluminum foil sheets. Additional electrical insulation in the form of 0.005-in. cellulose acetate sheet is

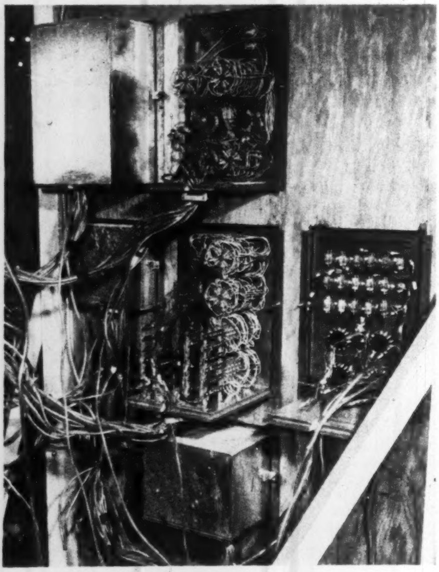


Fig. 10—Rear view of instrument console showing terminal strips and selector switches. All thermocouple wires are carried back to console in plastic tubing

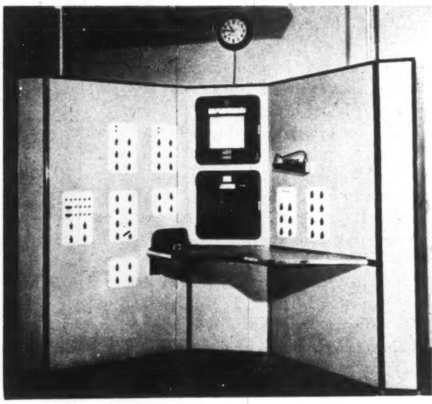


Fig. 11—Instrument console with temperature recording and indicating equipment

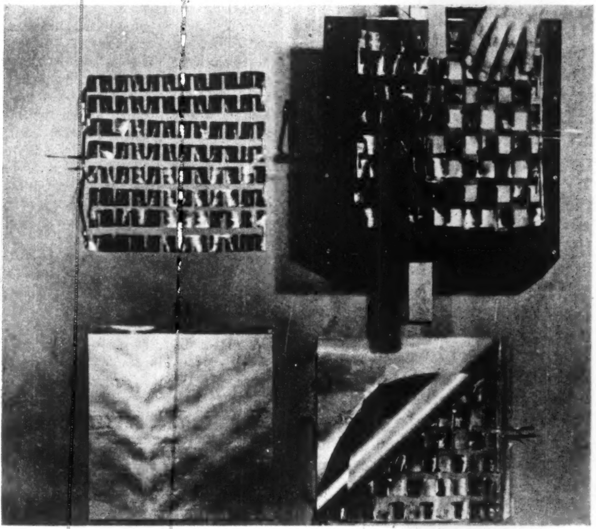


Fig. 12—Stages in production of gradient layer heat flow meter

placed between each sheet of aluminum foil and the thermal gradient layer. The whole unit is cemented together under heat and pressure. Several stages of the construction are shown in Fig. 12.

Checking and Calibration of Meters

When completed, the meters were checked to determine their relative calibration constants. The range of constants was small enough so that it was possible to *match* meters in such a way that all those on any one of the six-room surfaces had substantially the same calibration constant. This made it possible to parallel groups of meters and thereby reduce the number of observations required as well as the numerical work of reducing the test data. Lead wires from the meters installed on any given panel are carried to the sub-panels, previously mentioned, in the same tubing that carries the thermocouple leads. By means of rotary selector switches and paralleling switches, the output of selected groups of meters can be measured. Selector switches on the sub-panels are connected to the millivolt circuit of the indicating potentiometer through a master selector switch.

The meters were fastened to the panels by means of a tape with adhesive coatings on both sides. Warming the panels to about 140 F, and application of pressure by a vacuum press, facilitated bonding the meters to the surface. The edges were then sealed with a vapor proof tape. Fig. 13 shows the method of applying pressure by evacuating the space between a pressure plate and the meter.

The calibration constant and temperature coefficient of two matched meters were carefully determined. One of these meters was then used to calibrate all of the meters after they had been bonded to the panels. A research paper describing the construction and calibration of the meters in considerable detail is now in preparation.

Control Panel

The console type control panel is shown in Fig. 11. In addition to the indicating potentiometer shown in the lower half of the center section of the console, a 16-point electronic recording potentiometer is installed in the upper half of the center section. This instrument has a range of —1.0 to +2.0 millivolts. The sub-panel on the extreme left carries a bank of 16 double-pole double-throw toggle switches so that each sub-panel selector switch can be connected to the recorder. In this way the output of any heat flow meter or thermocouple or groups of meters or couples can be connected to the recorder.

Air Temperatures

Thermocouples of No. 26 gage copper-constantan wire are used to measure room air temperatures at the 30 in. and 60 in. levels. Measure-

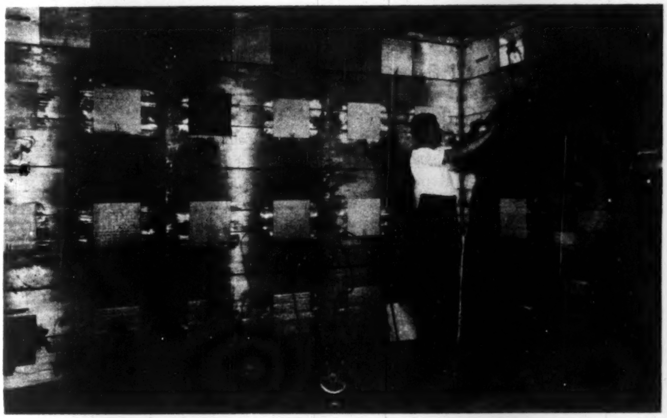


Fig. 13—Application of heat flow meters to aluminum panels

ments are made near the center of each half of one long wall and one short wall, both of which will be used primarily as neutral or inside walls. These couples are 1½ in. from the wall and correspond to commonly used thermostat locations. A fourth pair of couples measures air temperatures at the center of the room.

The temperature of the air entering the room as infiltration air through one or more of the six standpipes shown in Fig. 9 is measured by thermocouples in each of the pipes as well as in the main supply line at the metering orifice. The air quantity is indicated by the inclined manometer mounted on the right hand section of the console (see Fig. 11).

Air temperature gradients are measured by four strings of No. 36 gage copper-constantan thermocouples mounted on movable stands. There are two strings of eight couples each for vertical gradients and two of five couples each for horizontal gradients. The dewpoint temperature of the room air is determined from wet and dry bulb temperature measurements in the return air duct.

Air Motion

Air motion in the space is measured by a heated thermocouple anemometer of the type developed by Nottage[3]. Since this instrument has some directional properties, the flow direction is first established by smoke streams. The instrument is mounted on a portable stand to facilitate making surveys of air motion in the room.

Radiation Measurements

Instruments are provided for measuring mean radiant temperature, directional mean radiant temperature and resultant temperature. The mean radiant temperature is measured by means of a 6-in. globe thermometer with thermocouples as the sensing element, arranged as described by Houghten et al[4]. In order to determine the variation in mean radiant temperature (MRT) with position, it is mounted on a portable stand. In addition it is planned to develop an instrument based on the principles described by Benzinger[5] in order to make such traverses much more rapidly than can be done by the conventional slow-responding globe thermometer.

The directional mean radiant temperature is measured by a radiometer type instrument described by Korsgaard[6]. This instrument gives a result similar to that of the globe thermometer except that its view is from a flat surface.

The resultant thermometer, also described by Korsgaard[7], has a similar field of view. This instrument gives the indoor equivalent of the sol-air thermometer, that is, its indication gives the combined effect of convection and radiation on the transfer of heat to or from a surface element at the location of the instrument. To the extent that the convection coefficient for the resultant thermometer can be related to that for the human body, the resultant temperature is a measurement of comfort conditions.

Conversion for Environment Studies

As already indicated, every effort was made, in preparing the design details for the present room, to provide facilities that would be readily adaptable to a wide variety of uses. The present room will make possible studies on heat transfer between heated and cooled surfaces and the space they enclose, and for that reason, it is probably unique.

To fully justify the cost in time and money, the present facilities should be converted into a true psychrometric or environment laboratory as soon as conditions permit. Although some of the steps that might have to be taken to accomplish this are not too clearly defined at present, certain steps are clear. Among these are the following:

1. The erection of a partition to divide the space into two rooms. To do this the 6-in. wide panels can be removed and any kind of partition, selected as suitable, built on the framing already in place. If a partition of aluminum panels is chosen, tees are already in place to connect the panel into the present piping system. No major changes would be necessary in the piping in and above the crawl space. Additional pumps, and certain changes to the piping in the lower laboratory, may be required; the extent of these changes would largely be determined by the design conditions chosen for each of the two rooms.
2. Each of the two rooms would undoubtedly require a complete air-conditioning system capable of simultaneously controlling the temperature and humidity in the room. This would not mean the scrapping of existing equipment, but rather, the installation of additional equipment. Cooling effect could be obtained from the present refrigeration equipment. Additional pumps would probably be required to circulate the chilled liquid.
3. Conditioned air could be introduced into the rooms by substituting perforated panels for some or all of the present ceiling panels. Any other type of air inlet could be installed in either walls or ceiling. Exhaust grilles could probably be located in the new partition, or openings could be provided in the present walls with little difficulty.
4. Most or all of the instrumentation provided for the present room would also prove useful for psychrometric rooms. Space is available on the instrument console for any additional instrumentation required and if more space is required the wings of the console can readily be spread and a wider center panel installed.

Acknowledgments

In addition to the Committees specifically mentioned in this paper, grateful acknowledgment is due to many Society members and industry representatives for their help during the designing of the room and in the procurement of the equipment for it.

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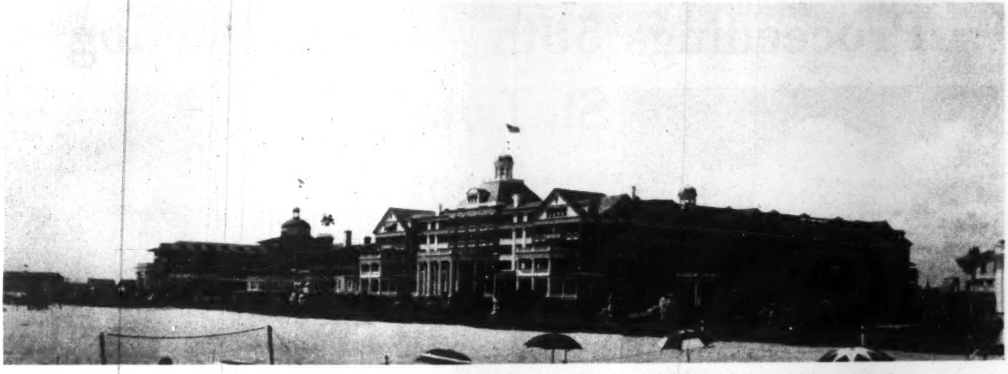
JOURNAL SECTION



The Essex and Sussex Hotel, Spring Lake, N. J., headquarters for the ASHVE Semi-Annual Meeting in June

Visit the Garden State in June Enjoy the Meeting by the Sea

THE shores of the blue Atlantic Ocean will be the site of the Semi-Annual Meeting 1952.

The New Jersey section of the New York Chapter will be hosts to all ASHVE members and their families who come to The Essex and Sussex in Spring Lake, N. J., June 16-18. Ernst Graber, president of New York Chapter, announced the appointment of F. H. Faust as general chairman of Committee on Arrangements and H. P. Morehouse as vice chairman.

Spring Lake, only 65 miles from New York, facing the Atlantic Ocean on a wide sandy beach, unique with its charming lake, adjacent to the business section, an abundance of shade trees and spacious lawns, off the main highway and away from the congested city areas, is a truly delightful summer resort.

An excellent program of technical sessions is planned by the Program and Papers Committee, with plenty of time being allotted for the enjoyment of the wonderful facilities of this seashore colony.

There are two 18-hole golf courses less than a mile from the hotel, and tennis courts are available at the hotel, free of charge. The hotel has its own mile-long boardwalk bordering its own private beach. Lockers, dressing rooms, beach chairs, etc., are provided without charge to the guests. Among other diversions available at the hotel are riding, fishing, and dancing. A feature of The Essex and Sussex is the luncheon served at Snug Harbor for those who plan a long session on the beach, and do not want to change clothes.

The hotel itself is situated in a group of beautiful gardens and, although off the main highways, is easily reached by automobile. The Pennsylvania Railroad shore line station is only one-half mile distant, with direct Newark-New York service, and all American Airlines' flights are available to Asbury Park, five miles distant. Within easy motoring distance are historic Princeton Atlantic Highlands and the famous Lakehurst Naval Air Station, home of the Navy's dirigibles, and Camps Dix and Kilmer.

The Essex and Sussex Room Rates

(*American Plan* — with meals)

Double Room, twin beds and bath, occupied by two persons	$15 daily per person
Single Room and bath	$18 daily per person
Parlor Suites, consisting of one or more double bedrooms and parlor	$15 daily for parlor
Combinations of double and single rooms, with bath between, accommodating three persons	$15 daily per person
Combinations of two double rooms, each with twin beds and bath between	
Rate on one of these rooms	$15 daily per person
Rate on the other room	$14 daily per person
Total rate for combination	$58 daily for 4 persons

In addition to the technical sessions, and the available recreational facilities at the hotel, there will be the Annual ASHVE Golf Tournament, and special activities for the ladies and the children.

Reservation blanks will be ready soon and mailed to all members. The Essex and Sussex is on the American Plan and a brief schedule of rates is shown. However, for those who desire it, accommodations on the European Plan (without meals) are available at several adjoining hotels. A complete listing with all the rates will be on the reservation blank.

A large attendance is anticipated and with New Jersey's ideal June weather at this lovely resort, an unforgettable three days are in prospect for everyone. The Committee is hopeful that you will plan to save these three days, June 16, 17, and 18, for the Semi-Annual Meeting in Spring Lake, N.J.

JOURNAL SECTION

Proceedings 58th Annual Meeting St. Louis

Lauren E. Seeley, Durham, N. H.
President

Ernest Szekely, Milwaukee, Wis.
President-Elect

At the 58th Annual Meeting in St. Louis, Mo., attendance records for a non-exposition meeting were broken. Final total registration figures were 1068, including 630 members, 221 ladies, and 217 guests. The election of new Officers was announced at the Tuesday morning session by L. Walter Moon, chairman of the Inspectors of Election, and they were inducted at the final technical session on Wednesday afternoon. They are: *President*—Ernest Szekely, Milwaukee, Wis.; *First Vice President*—Reg F. Taylor, Houston, Tex.; *Second Vice President*—L. N. Hunter, Johnstown, Pa.; and *Treasurer*—J. Donald Kroeker, Portland, Ore.

The four new Council members elected for a three-year term are: M. K. Fahnestock, Urbana, Ill.; P. B. Gordon, New York, N.Y.; R. T. Kern, Fitchburg, Mass.; and D. M. Mills, Houston, Tex. Bruce L. Evans of St. Louis was elected for a one-year term by the Council to fill a vacancy.

New members elected to the Committee on Research for a three-year term are: I. W. Cotton, Indianapolis, Ind.; W. A. Grant, Syracuse, N.Y.; N. B. Hutcheon, Ottawa, Canada; B. H. Jennings, Evanston, Ill.; and C. O. Mackey, Ithaca, N.Y.

The proceedings of the technical sessions and various reports follow:

FIRST SESSION, MONDAY, JANUARY 28, 2:30 P.M.

Pres. Lauren E. Seeley called the 58th Annual Meeting to order at 2:30 p.m. in the Ballroom, Hotel Statler, following the get-together luncheon at which L. L. Hamig, president of the St. Louis Chapter, welcomed the members and guests to the meeting.

The president announced that the following members were appointed as Inspectors of Election: L. Walter Moon, *chairman*, St. Louis, J. J. Bechtol, Cincinnati, C. H. McGuiness, Des Moines.

President Seeley then presented the Report of the President.

President's Report

It is a pleasure to report to members of The American Society of Heating and Ventilating Engineers that the year of 1951 has been one of continued growth and improvement, and that the future presents only the natural problems of an active and developing organization. The Council of the Society has performed its duties faithfully and energetically.

Committees have functioned effectively and Committee Chairmen have exemplified the unselfish service which distinguishes professional men. The key to the success of our Society rests in the generous, voluntary services of many of our members and the continued friendly and cooperative spirit of the whole membership. When all is said and done the greatest single asset of our Society is the friendly spirit which animates it so universally.

On the other side of the picture there is a vast job of administration to be done for this organization. The machine has run so well that many members do not realize the load that has been building up in terms of increased membership. The evidence of this load is somewhat clearer now. For one thing the Society was forced to move to new quarters in order to have the increase in space required. The Executive Secretary and his staff are entitled to our sincere thanks.

The new By-Laws caused a revival of study as related to organization and procedures. A better understanding of a membership corporation has developed. Our status as a scientific and educational Society devoted to the public welfare and the concurrence of the Commissioner of Internal Revenue therewith, which emphasizes the professional nature of our organization, are matters which are constantly kept in mind.

An important Council decision in October 1950 was to approve the plan of preparing and issuing Operational Guides for each functioning unit of the Society. This was to insure conformity to our By-Laws and to secure better administration, especially in assuring more consistent continuity of effort in the face of periodic changes in personnel. The time required to get the whole job done cannot be predicted.

It should be noted that the growth in membership alone would require more systematic handling of Society affairs regardless of the By-Laws. The growth in the number and size of Chapters is the inevitable result of increased membership. For many members the Chapter is and will continue to represent the Society. As one might expect, there are some who wish to resist this increase in Chapters and others who want to encourage it. The resistance is aroused more by a fear of multiplying numbers at some risk to quality rather than a denial of the Chapter as a useful and proper unit within the Society. It was proposed that quality could be better insured by issuing some form of probationary approval to new Chapters which would require satisfactory performance and proof of ability to survive the hazards of the formative years. This proposal has not yet been accepted but it is believed that its merits should be reviewed.

The history of Student Branches is generally not too satisfactory, but there are some gratifying exceptions. Success is found where a strong, enthusiastic and professionally superior teacher or closely associated Chapter membership put their leadership into the Branch.

Another important decision effective this year was the new plan for raising money for research. After considerable groping in 1950 as to a new plan for money raising, it was finally agreed in principle that money raising was a financial problem and therefore the responsibility of the Finance Committee. The By-Laws make this clear. It was agreed by Council to approve a Ways and Means Committee as a subcommittee of the Finance Committee to develop and conduct a plan for fund raising. This committee was appointed and a plan was devised which was business-like and clear. The plan was put into effect and, while it operated only during the latter half of our fiscal year, its performance was gratifying. Its work has been carefully studied and a decision was reached that the plan does work and that it should be continued. If the prospects of this plan are realized the future support of research should rest on a firm foundation.

This year there has been a resurgence of interest in the matter of codes and standards — a phase of Society activity which has lain fallow for many years. The matter is under study though it is doubtful that the full effects of this work will materialize at once. The whole question is complex and yet it seems that there is some element of leadership in our field that it is incumbent for the Society to assume. It is hoped that the matter will be pursued until a satisfactory conclusion is reached.

A matter of increasing difficulty is the scheduling of future meetings. The Council has authorized the preparation of a long-range schedule. This has been done and it is hoped that such a schedule will be helpful. The increase in the size of our meeting constantly whittles away the number of feasible meeting places. Besides that, it is necessary to make reservations several years in advance due to the large number of organizations which have problems similar to ours.

The Council has spent some time on the matter of awards and prizes. An Awards Committee has been authorized to study the whole question in the hope that an ideal schedule of prizes and awards may be developed, if the committee believes that prizes and awards constitute a proper and valuable place in our Society.

The Society has been represented by the President on the Exploratory Committee of the Engineers Joint Council on the matter of unity in the engineering profession. It is a big problem, and in time, rather specific proposals may be expected to emerge. These will require careful thought of Officers and Council as well as the reactions from the membership as a whole. No recommendations can be made at this time except to continue a cooperative attitude with this undertaking as evidence of our interest in the development of the engineering profession.

It has been suggested that the time has arrived when we should make a complete study of our Society. We have grown rather fast. We are not the Society that we were even a decade ago. Are we doing today the things that our members want us to do? It is a fair question and an important one. There is always the question of timing. Is it timely to study ourselves objectively from stem to stern? This means our manifold committee jobs, our research, our publications, our Chapters, our finances, and so forth. One thing is clear. This is a membership corporation. The member is supreme and he should have what he wants within, of course, the broad objectives for which we are chartered.

There are always those who feel that we should "let well enough alone." We cannot be sure however that things are "well enough." A study of the kind being suggested is a major undertaking that may require several years of effort. The future is not too certain or too secure for us to justify inaction. It is hoped that this proposal will receive careful consideration.

The meetings of the Society continue to be good. The Portland meeting was an unqualified success and a compliment to the Oregon Chapter. The resumption of greater formality in the installation of Officers has been decided upon, but otherwise no changes are suggested.

In this report there has been an avoidance in the use of names. It was a question of avoiding names entirely or else including a large number of names with a certainty that the list would somehow be incomplete. Sincere thanks are given to the Officers, Council, Committees and staff for wholehearted cooperation and effective services. The Society will be in good hands next year and the years thereafter. No one can serve the Society without experiencing a richer life and innumerable friendships.

Respectfully submitted,
L. E. SEELEY, *President*

AMERICAN SOCIETY
OF
HEATING & VENTILATING
ENGINEERS

Pres. Seeley and 1st Vice Pres. Szekely welcome French Delegation at 58th Annual Meeting visiting U.S. under Marshall Plan auspices

JOURNAL SECTION

Report of Council

As required by Section 46 of the Membership Corporations' Law of the State of New York, the following report is presented by Council and filed herewith:

Assets

The Society has the following Assets:

Land and Laboratory Buildings at Cleveland, Ohio	$ 81,012.89
Furniture & Equipment, Tools, etc., at New York and Cleveland	39,982.77
On Deposit in New York and Cleveland Banks	138,895.95
Securities (United States and Canadian Government Bonds) with Bankers Trust Company, New York, as Custodian	98,917.57
Accounts Receivable	18,316.63
Inventory Items	11,284.26
Deferred Items	4,561.67
Miscellaneous	2,831.63
TOTALS	$395,803.37
1950 TOTAL	392,240.00
INCREASE	$ 3,563.37

The sources of Society Cash Receipts were: Admission Fees and Dues $107,396.39; Publications $150,274.36; Interest $1,170.07; from Research $183,792.27; and Miscellaneous $328.00; making a total of $442,961.09. Cash Disbursements for Meetings, Committees and Chapters were $34,194.20, Publications $109,199.05, Headquarters $120,151.93, Research $170,823.05 — Total $434,368.23.

The Society's Reserve Fund was increased by the addition of $5,836.00 Admission Fees and $1,591.42 Interest earned on Savings Bank Accounts and Securities. This is an increase of $7,427.42, bringing the Reserve Fund to $75,204.40.

Now in the Custodian Account of the Bankers Trust Co., New York, there are Securities of the United States and Canadian Governments which cost: General Fund $32,008.25, Reserve Fund $53,631.50, and F. Paul Anderson Fund $1,000.00. The Research Reserve Fund now stands at $34,741.43.

Liabilities

The Society has the following Liabilities:

Accounts Payable	$ 25.00
Federal Withholding Taxes	768.90
Accrued Accounts	12,151.30
Deferred Income:	
Research Projects	3,924.39
Prepaid Dues, Initiation Fees, etc.	3,892.13
Reserve for TRANSACTIONS	17,000.00
Net Worth (Funds)	358,041.65
TOTAL	$395,803.37

At the end of the fiscal year, October 31, 1951, the Balance Sheet shows the Society's Net Worth as $358,041.65 compared to $327,700.33 on October 31, 1950, a net gain of $30,341.32.

The Property Fund covering the Laboratory Land and Buildings at Cleveland, Laboratory Equipment and Tools, Furniture and Fixtures at Headquarters, New York and Cleveland is $120,995.66.

Fire Insurance of $155,000.00 is carried on Buildings, $51,000.00 on Contents, Sprinkler $12,000.00, also Comprehensive Bodily Injury $100,000.00 — $300,000.00 and Auto Property Damage $5,000.00. Fidelity Bonds on Officers and all employees $20,000.00. Workmen's Compensation is carried in New York and Ohio, as required by law.

The Society has contributed to the Employees Retirement Plan Trust $2,401.36 and the participating employees contributed a similar amount.

Total Cash in New York and Cleveland Banks $138,895.95, consisting of $73,162.65 in General Operating Fund, $12,376.95 in Reserve Fund, $166.55 in F. Paul Anderson Fund, $17,760.71 in the Research Fund, $34,741.43 in Research Reserve, and $687.66 in Research Endowment.

Membership

The Society admitted the following members in the grades indicated since January 1, 1951:

Members	176
Associate	
Affiliates	192
Junior Members	291
Students	219
TOTAL	878

The names and addresses of the candidates for membership were published in the JOURNAL of the Society each month during the year and are on record in the Secretary's office. The present membership total is 8,503.

Respectfully submitted,
LAUREN E. SEELEY, *President*
H. E. SPROULL, *Treasurer*

Second Vice Pres. Reg F. Taylor presented a brief review of the condition of the Society and some of the significant activities of the Finance Committee, and said that the reports of the treasurer and auditor would provide a full financial report.

Treasurer's Report

At the first of the fiscal year, the Society's financial picture begins with a budget, for all contemplated activities of the Society, as prepared by the Finance Committee, and adopted and approved by Council action.

All funds received by the Society are deposited in the Treasurer's Account in one of two New York banks. Periodically, the Executive Secretary, in line with the Budget and instructions from the Council, supplies the Treasurer with a statement of the vouchers and disbursements which should be made. After approval of the vouchers and statements by the Chairman of the Finance Committee, checks are issued, signed by the President and Treasurer, to replenish the bank accounts of the Executive Secretary with the necessary funds, with which to pay the vouchers.

Once a year an audit is made by the Certified Public Accountant, appointed by the Council.

I hereby present the audit and Report of Frank G. Tusa & Co. — Certified Public Accountants, covering the Fiscal Year ending October 31, 1951. This report gives detailed information concerning the finances of the Society, and essential portions of the report are published in the following pages.

The present financial status of the Society is very good. The amount of dues, receivable for October 1951 was about the same as for the corresponding time in 1950.

On the statement of Income and Expenses, there is an excess of income over expenses of $22,371.65, part of which resulted from not issuing two volumes of TRANSACTIONS, as contemplated. Of the total income of $454,258.55, 37 percent or a little over one-third — $170,326.49 — was received from dues of members. $151,328.44, or one-third, was received from THE GUIDE and JOURNAL, and about 28 percent, or $124,544.33, was received from contributions for Research and from the Philadelphia Exposition.

Thus expenditures of the Society for the year averaged approximately $54.00 per member, which is considerably more than double the amount of dues paid per member.

The Balance Sheet of the Report shows a small over-all gain for the year, but the net worth of the Society has increased about 10 percent — or a net worth today of $358.041.65.

Among the assets of the Society are the land and laboratories in Cleveland and the furniture, equipment, tools, etc., at New York and Cleveland, representing $120,995.66. In addition, the Society owns securities in the form of U. S. and Canadian bonds amounting to $98,066.85, market value.

The Society reserve fund, as provided for in *Article IV, Section 2*, has reached $75,204.40, or approximately 60 percent of the allowable authorized sum of $15.00 per member.

The operations of the Committee on Research show some excess of income over expenses, but part of the surplus is noted on the balance sheet as reserve for earmarked projects. Research contributions show an increase in general contributions, and some decrease in ear-marked funds.

It is costing the Society about $35,000 per month to operate, but on the budget comparison — Cash Receipts Total Income exceeded Budget Estimate; and on the disbursement side, expenses were substantially under the budget provision.

In accordance with our Charter, the Society is dedicated to the advancement of the Arts and Sciences of Heating, Ventilating, Cooling and Air Conditioning for the benefit of the general public. In spending the $434,368.23 this past year, we can indeed be proud of the accomplishment and wise handling of funds toward this goal.

Respectfully submitted,
HOWARD E. SPROULL, *Treasurer*

Accountant's Report

Frank G. Tusa & Co.
Certified Public Accountants
37 Wall St.
New York 5, N. Y.

The American Society of Heating
and Ventilating Engineers
62 Worth St.,
New York 13, N. Y.

Gentlemen:

Pursuant to your request, we examined the books of account and records of The American Society of Heating and Ventilating Engineers, New York, and Cleveland, and its related funds for the fiscal year ended October 31, 1951, and submit herewith our report.

The audit covered a verification of the Assets and Liabilities as of the close of business October 31, 1951. For the fiscal year then ended, the recorded cash receipts were traced into the depositories; the cancelled bank checks were inspected and compared with the record of cash disbursements, and the disbursements were supported by payment vouchers. The dues from members and the interest from investments were accounted for.

A Balance Sheet reflecting the financial condition of the Society as of the close of business October 31, 1951 is submitted herewith and your attention is directed to the following comments thereon:

CASH

The Cash on Deposit was verified by direct communication with commercial and savings banks and the balances reported to us were reconciled with those reflected by the books of the Society. A schedule of cash is included as a part of this report.

Checks representing the cash on hand for deposit were inspected by us and the cash on hand was counted.

MARKETABLE SECURITIES

The securities shown on the subjoined schedule were verified by direct communication with the Bankers Trust Co., where same are deposited for safe-keeping. Securities have been included in the accompanying balance sheet at the cost of acquisition plus the accumulated and accrued interest earned thereon.

ACCOUNTS RECEIVABLE

Trial balances taken of the Membership dues receivable and sundry debtors as of the close of business October 31, 1951 were classified and aged as follows:

Membership	Total
Members	$ 3,254.56
Associates	5,837.44
Affiliates	375.00
Juniors	1,705.47
Students	607.50
Total	$11,779.97

SUNDRY DEBTORS

Unpaid charges made during October, 1951	$4,244.26
Unpaid charges made during September, 1951	1,192.75
Unpaid charges made prior to September, 1951	2,819.05
Total	$8,256.06

After writing off receivables known to be uncollectable, it is our opinion that the reserves for dues and accounts receivable doubtful of collection reflected in the accompanying Balance Sheet are ample to cover collection losses that may be incurred.

RESEARCH FUND ACCOUNT RECEIVABLE

The Balance due to the Research Fund from the Society as at October 31, 1951 represents 40% of Dues Receivable from Members, Associates and Affiliates as of such date.

INVENTORIES

The following inventories were verified either by count or direct communication:

Transactions	$ 4,598.20
Emblems	514.94
Guide Paper	6,171.12
Total	$11,284.26

A schedule of Transactions inventoried follows:

Volume	Year	Quantity	Price	Amount
1949	1895-1943	3,187	$ .40	$1,274.80
1950	1944	170	1.82	309.40
1951	1945	335	1.91	639.85
1952	1946	378	1.67	631.26
1953	1947	151	1.77	267.27
1954	1948	829	1.78	1,475.62
Total				$4,598.20

DEPOSIT RECEIVABLE

The deposit placed with the United Air Lines in the sum of $425.00 was verified by direct communication.

ADVANCES

The indebtedness from employees in New York and Cleveland represents advances to the Employees' Retirement Plan in the sums of $1,429.66 and $976.97 respectively. This indebtedness is to be reimbursed by the Trust during the ensuing fiscal year.

DEFERRED CHARGES

The following prepayments have been deferred to future expenses:

HPAC Subscription	$2,590.50
Advertising Sales Promotion	1,350.00
Insurance Premium — New York	413.37
Insurance Premium — Cleveland	207.80

PERMANENT ASSETS

The Land and Buildings, Instruments, Equipment and Furniture and Fixtures are reflected on the Balance Sheet at cost of acquisition. With the exception of Land and Buildings all assets have been depreciated at the rate of 10 percent per annum. During the year fully depreciated Furniture and Fixtures in the amount of $329.25 was written off against the reserve.

In accordance with the resolution adopted by the Council at its meeting of January 23, 1949, depreciation was not provided on the Buildings for the current fiscal year.

TAXES

The sum of $768.90 represents Federal Income Taxes withheld from employees salaries during the month of October, 1951.

DEFERRED INCOME

The prepaid dues and initiation fees by members and candidates for membership have been deferred to future operations. The membership classification of the dues prepaid by elected members follow:

Membership	Amount
Members	$ 360.94
Associates	83.00
Affiliates	124.75
Juniors	447.59
Students	71.35
Total	$1,087.63

RESERVE FOR TRANSACTIONS

Out of the original $12,500.00 Reserve for Transactions Vol. 55 there remains an unexpended balance of $4,500.00 which is considered ample for the completion of this volume. The reserve of $12,500.00 provided for Vol. 56 in the 1950 budget is also reflected in the accompanying Balance Sheet. However, since the 1951 budget did not provide for the publication of Vol. 57, no reserve was provided for same.

FUNDS

There is included as a part of this report an analysis of funds reflecting the changes that occurred therein during the fiscal year ended October 31, 1951.

INSURANCE

The insurance coverages of the Society follow:

Fire		
Building (Cleveland)		$155,000.00
Personal Property:		
Cleveland	$29,000.00	
New York	20,000.00	
Printers	2,000.00	51,000.00
Sprinkler Leakage	12,000.00	
Comprehensive — Automobile		
Public Liability		100/300M
Property Damage		5M
General Public Liability — Premises		
Liability		100/300M
Bodily Injury		5/25M
Parcel Post Open Policy		600.00
Commercial Blanket Bond		
All employees including the President, Treasurer and Chairman of the Finance Committee		20,000.00

Respectfully submitted,
FRANK G. TUSA & CO.
Certified Public Accountants

JOURNAL SECTION

BALANCE SHEET

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N.Y. — October 31, 1951

ASSETS

GENERAL FUND				
CASH				
On Hand and On Deposit			$73,162.65	
SECURITIES				
At Cost (Market Value $34,281.40)		$32,008.25		
Add: Accumulated Interest		3,069.37	35,077.62	
ACCOUNTS RECEIVABLE				
Membership Dues	$11,779.97			
Less: Reserve for Doubtful	4,269.14	7,510.83		
Advertisers and Sundry Debtors	8,256.06			
Less: Reserve for Doubtful	1,000.00	7,256.06		
Initiation Fees		77.00	14,843.89	
INVENTORIES			11,284.26	
DEPOSIT WITH UNITED AIRLINES			425.00	
ADVANCES TO EMPLOYEES PENSION TRUST			1,429.66	
DEFERRED CHARGES			4,353.87	$140,576.95
RESEARCH FUND				
CASH				
On Hand and on Deposit			17,760.71	
ACCOUNTS RECEIVABLE				
40% of Dues	$ 4,054.39			
Less: Reserve for Doubtful	1,517.25	2,537.14		
Due from U.S. Navy Department		3,446.24		
Miscellaneous		15.00		
Hospitalization — Employees		11.50	6,009.88	
ADVANCES TO EMPLOYEES PENSION TRUST			976.97	
DEFERRED CHARGES			207.80	24,995.36
PROPERTY FUND				
Land and Buildings		84,920.96		
Less: Reserve for Depreciation		3,908.07	81,012.89	
Laboratory and Equipment (Cleveland)		55,914.37		
Less: Reserve for Depreciation		23,997.54	31,916.83	
Furniture and Fixtures (New York)		10,138.20		
Less: Reserve for Depreciation		2,672.26	7,465.94	
Library (Cleveland)			300.00	
Tools (Cleveland)			300.00	120,995.66
RESERVE FUNDS				
Cash on Deposit			12,376.95	
Securities at Cost (Market Value $62,827.45)		53,631.50		
Add: Accumulated Interest		9,195.95	62,827.45	75,204.40
ENDOWMENT FUNDS				
F. PAUL ANDERSON FUND				
Cash on Deposit			166.55	
Securities at cost (Market Value $958.00)		1,000.00		
Add: Accrued Interest		12.50	1,012.50	1,179.05
RESEARCH FUND				
Cash on Deposit				687.66
RESEARCH RESERVE FUND				
Cash on Deposit				34,741.43
				$398,340.51

LIABILITIES

GENERAL FUND				
FEDERAL WITHHOLDING TAXES			$ 768.90	
DUE RESEARCH			2,537.14	
ACCRUED ACCOUNTS				
Salaries and Commissions		$11,151.30		
Professional Fees		1,000.00	12,151.30	
DEFERRED INCOME				
Prepaid Membership Dues:				
Elected Members	$1,087.63			
Candidates	884.50	1,972.13		
Prepaid Admission Fees		1,820.00		
Junior-Student Member Award		100.00	3,892.13	
EXCHANGE			25.00	
RESERVE FOR PUBLICATIONS				
TRANSACTIONS — Vol. 55		4,500.00		
TRANSACTIONS — Vol. 56		12,500.00	17,000.00	$ 36,374.47
RESEARCH FUND				
DEFERRED INCOME				
Sound Energy — Studies			574.39	
Periodic Heat Flow Through Roofs			1,175.00	
Summer Infiltration			1,175.00	
Insulation			1,000.00	3,924.39
FUNDS				
Property Fund			120,995.66	
General Fund			104,202.48	
Reserve Fund			75,204.40	
F. Paul Anderson Fund			1,179.05	
Research Fund			21,030.97	
Research Reserve Fund			34,741.43	
Research Endowment Fund			687.66	358,041.65
				$398,340.51

CONDENSED COMPARATIVE BALANCE SHEET

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N.Y. — October 31, 1951

	October 31, 1951	October 31, 1950	Increases Decreases
ASSETS			
Cash on Hand, on Hand for Deposit and on Deposit	$138,895.95	$131,593.89	$ 7,302.06
Securities (At Cost—Plus Accumulated and Accrued Interest)	98,917.57	100,713.05	(1,795.48)
Accounts Receivable (Less: Reserve for Doubtful Accounts)	18,316.63	18,174.46	142.17
Inventory of Paper, Emblems, Etc.	11,284.26	14,679.96	(3,395.70)
Deposits Receivable	425.00	425.00	-0-
Accommodations	2,406.63	2,419.23	(12.60)
Land and Buildings (Less: Reserve for Depreciation)	81,012.89	81,012.89	-0-
Laboratory Equipment, Tools, Furniture, Fixtures and Library (Less: Reserve for Depreciation)	39,982.77	38,553.40	1,429.37
Deferred Charges	4,561.67	4,668.12	(106.45)
TOTAL ASSETS	$395,803.37	$392,240.00	$ 3,563.37
LIABILITIES			
Accounts Payable	$ 25.00	$ -0-	$ 25.00
Federal Withholding Taxes	768.90	552.70	216.20
Accrued Accounts	12,151.30	11,597.66	553.64
Deferred Income:			
Research Projects	3,924.39	9,156.89	(5,232.50)
Prepaid Dues, Initiation Fees, Etc.	3,892.13	14,585.48	(10,693.35)
Reserve for Publication of Transactions	17,000.00	28,646.94	(11,646.94)
TOTAL LIABILITIES	37,761.72	64,539.67	(26,777.95)
FUNDS			
Property Fund	120,995.66	119,566.29	1,429.37
General Fund	104,202.48	95,971.35	8,231.13
Reserve Fund	75,204.40	67,776.98	7,427.42
F. Paul Anderson Fund	1,179.05	1,150.97	28.08

FUNDS (*Continued*)

Research Fund	21,030.97	21,308.18	(277.21)
Research Reserve Fund	34,741.43	21,252.46	13,488.97
Research Endowment Fund	687.66	674.10	13.56
NET WORTH	358,041.65	327,700.33	30,341.32
TOTAL LIABILITIES AND FUNDS	$395,803.37	$392,240.00	$ 3,563.37

STATEMENT OF INCOME AND EXPENSES

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N.Y.—For the Fiscal Year Ended October 31, 1951

INCOME

INCOME FROM DUES				
104 MEMBERS	$78,161.84			
Less: Cancellations	610.50	$77,551.34		
Less: 40% to Research Fund		31,020.54	$ 46,530.80	
105 ASSOCIATES	63,728.65			
Less: Cancellations	300.00	63,428.65		
Less: 40% to Research Fund		25,371.46	38,057.19	
105A AFFILIATES	7,774.00			
Less: Cancellations	100.00	7,674.00		
Less: 40% to Research Fund		3,069.60	4,604.40	
106 JUNIORS		19,493.00		
Less: Cancellations		265.50	19,227.50	
107 STUDENTS		2,484.00		
Less: Cancellations		39.00	2,445.00	
TOTAL DUES				$110,864.89
OTHER INCOME				
108 Admission Fees			5,836.00	
109 Emblems			284.48	6,120.48
INCOME FROM PUBLICATIONS				
115 JOURNAL Contract			23,499.96	
300 GUIDE (Per Schedule Attached)			125,208.63	
117 TRANSACTIONS			566.39	
118 Books, Reprints and Codes			2,053.46	151,328.44
INVESTMENT INCOME				
125 Interest — Savings Banks			424.23	
126 Interest — Securities			1,469.85	1,894.08
RESEARCH				
FROM ASHVE				
40% of Members, Associates and Affiliates				$ 59,461.60
FROM U. S. NAVY RESEARCH				31,470.21
CONTRIBUTIONS				
GENERAL — PER SCHEDULE			$ 12,870.00	
EARMARKED				
Received during the current fiscal year — Per Schedule	$41,983.26			
Add: Deferred from Prior Years	9,156.89	$51,140.15		
Deduct: Deferred to future operations		3,924.39	47,215.76	
1951 EXPOSITION CONTRIBUTIONS			32,988.36	93,074.12
INTEREST EARNED				44.73
				184,050.66
TOTAL INCOME				454,258.55

EXPENSES

COMMITTEES AND CHAPTERS — SCHEDULE F		
150 Officers Travel	$ 4,126.89	
151 Council and Council Committee Travel	7,906.36	
164 Standards Committee	256.44	
170 Admissions and Advancement Committee Travel	536.78	
171 Charter and By Laws Travel	253.03	
172 Nominating Committee Travel	2,490.86	
173A Chapter Speakers Travel	1,517.60	
173B Chapter Conference Committee Travel	4,723.71	
173C Chapter Relations Committee	540.15	
175 Building Committee	2,806.37	
201 ASA Membership Dues	100.00	
204 Membership Certificates	471.70	
205 Emblems	166.07	
206 Medals and Awards	313.86	26,209.82
MEETINGS — SCHEDULE		
163 Meetings	6,190.84	
327 Chapter Annual and Semi-Annual Meeting Allowances	1,575.31	7,766.15
PUBLICATION — SCHEDULE		
200 Members Subscriptions to HPAC	16,534.36	
202 TRANSACTIONS	267.36	
203 Membership Roll	7,233.70	
208 Books, Reprints, Codes, Charts, etc.	1,619.77	
305 GUIDE (Per Schedule Attached)	75,474.49	101,129.68
HEADQUARTERS — SCHEDULE		
210 Salaries — Secretary and Staff	65,319.09	
210A Social Security Taxes	394.18	
211 Public Relations	5,836.03	
212 Traveling — Secretary and Staff	2,945.93	
213 Rent and Light	6,522.93	
214 Telephone	1,772.32	
215 Telegraph	658.78	
216 Postage	5,131.19	
217 Printing and Stationery	5,477.25	
219 Addressing and Address Changes	383.06	
220 Professional Services	2,878.32	
221 Bank Charges	50.60	
222 Insurance	590.09	
11 Depreciation — Furniture and Fixtures	935.75	
223 Office Expenses	1,826.94	
223A Moving Expenses	5,507.18	
224 Pension	1,091.62	107,321.26
FUND RAISING — SCHEDULE		
350 Salaries and Fees	7,455.00	
351 Travel	813.95	
352 Printing	2,282.67	
353 Exhibit at Exposition	205.30	
354 Postage and Misc. Expenses	1,397.32	12,154.25
RESEARCH		
COMMITTEE EXPENSES		
Committee Travel	2,203.85	
Chairman and Executive Com. Travel	1,660.84	
Open House Expenses	643.72	4,508.41
STAFF SALARIES		
Administrative, Engineering and Tech.	64,552.66	
Clerical	11,065.35	
Pensions	1,309.74	
Part Time	12,182.37	
Consulting Services	216.34	
Social Security	818.55	90,145.01
LABORATORY EXPENSES		
General Staff Travel	2,829.94	
Society Meeting Travel	1,854.70	
Postage	489.21	
Telephone and Telegraph	1,983.83	

LABORATORY EXPENSES (*Continued*)			
Office Supplies	1,019.38		
Mimeographing	1,879.95		
Library and Reprints	330.71		
Professional Services	472.86		
Workmen's Compensation Insurance	228.12		
Laboratory Materials and Supplies	7,905.81		
Depreciation of Equipment	5,303.61	24,298.12	
BUILDING OPERATIONS AND MAINTENANCE			
Power	1,647.20		
Heating	1,182.24		
Water	47.83		
Janitors Wages	2,687.59		
Janitors Supplies	368.43		
Building Maintenance	965.36		
Building Insurance	576.08	7,474.73	
U. S. NAVY RESEARCH			
Staff Salaries	11,663 67		
Committee Travel	119.07		
Staff Travel	142.49		
Materials, Supplies and Equipment	11,515.12	23,440.35	
COOPERATIVE RESEARCH AGREEMENTS			
Case Institute of Technology	2,500.00		
Columbia University	200.00		
Kansas State College	3,200.00		
Northwestern University	1,500.00		
Pennsylvania State College	2,200.00		
University of Florida	1,000 00		
University of Illinois	6,500.00		
University of Minnesota	3,400.00		
Traveling and Materials	520.02	21,020.02	
		170,886.64	425,467.79
NET INCOME			28,790.76
OTHER DEDUCTIONS			
Admission Fees Allocated to Reserve Fund		5,836.00	
Loss from Canadian Exchange		480.61	
Loss on Redemption of U. S. Treasury Bonds		102.50	6,419.11
EXCESS OF INCOME OVER EXPENSES			$ 22,371.65

BUDGET COMPARISON — CASH RECEIPTS

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N. Y. — For the Fiscal Year Ended October 31, 1951

DUES — SCHEDULE A

	Actual	Budget Provision	Increases	Decreases
CURRENT MEMBERS				
6A—Members	$ 38,892.15	$ 45,000.00	$	$ 6,107.85
6B—Associates and Affiliates	33,738.71	45,000.00		11,261.29
6C—Juniors	13,072.03	8,000.00	5,072.03	
6D—Students	1,496.10	2,000.00		503.90
	87,198.99	100,000.00	5,072.03	17,873.04
NEW MEMBERS				
104—Members	1,934.21	2,250.00		315.79
105—Associates and Affiliates	2,433.30	1,500.00	933.30	
106—Juniors	2,724.75	1,000.00	1,724.75	
107—Students	562.25	450.00	112.25	
	7,654.51	5,200.00	2,770.30	315.79
PRIOR YEARS DUES				
6E—Members	1,771.05	1,500.00	271.05	
6F—Associates and Affiliates	2,653.28	2,400.00	253.28	
6G—Juniors	562.50	500.00	62.50	
6H—Students	106.00	200.00		94.00
	5,092.83	4,600.00	586.83	94.00
TOTAL DUES	99,946.33	109,800.00	8,429.16	18,282.83
108—Admission Fees	6,367.50	4,500.00	1,867.50	
DEFERRED INCOME				
6I—Prepaid Dues by Members	310.06	250.00	60.06	
6J—Prepaid Dues by Candidates	772.50	750.00	22.50	
	1,082.56	1,000.00	82.56	
PUBLICATION—SCHEDULE B				
115—JOURNAL Contract	23,499.96	23,500.00		.04
300—GUIDE Advertising	74,976.54	67,000.00	7,976.54	
302—GUIDE Copy	49,383.49	52,000.00		2,616.51
117—TRANSACTIONS	597.35	1,500.00		902.65
118—Books, Reprints and Codes	1,817.02	1,000.00	817.02	
	150,274.36	145,000.00	8,793.56	3,519.20
INVESTMENTS—SCHEDULE C				
125—Int.—Savings Banks	$ 584.13	$ 800.00	$	$ 215.87
126—Interest—Securities	585.94	800.00		214.06
	1,170.07	1,600.00		429.93
OTHER RECEIPTS—SCHEDULE D				
109—Emblems	328.00	500.00		172.00
	328.00	500.00		172.00
RESEARCH LABORATORY RECEIPTS SCHEDULE E				
40% of Members, Associates and Affiliates Dues	58,373.46	65,100.00		6,726.54
Contributions—Earmarked	41,983.26	60,000.00		18,016.74
Contributions—General	12,870.00	10,000.00	2,870.00	
Contributions—Exposition	32,988.36	—0—	32,988.36	
Navy Research	37,018.29	39,700.00		2,681.71
Interest	558.90	—0—	558.90	
	183,792.27	174,800.00	36,417.26	27,424.99
TOTAL RECEIPTS	$442,961.09	$437,200.00	$55,590.04	$49,828.95

BUDGET COMPARISON — CASH DISBURSEMENTS

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
New York, N.Y. — For the Fiscal Year Ended October 31, 1951

	Actual	Budget Provision	Increases	Decreases
COMMITTEES AND CHAPTERS—SCHEDULE F				
150—Officers Travel	$ 4,126.89	$ 4,000.00	$ 126.89	$
151—Council and Council Committee Travel	7,673.25	8,500.00		826.75
164—Standards Committee	256.44	750.00		493.56
170—Admissions and Advancement Committee	536.78	600.00		63.22
171—Charter and By-Laws	253.03	300.00		46.97
172—Nominating Committee	2,490.86	2,500.00		9.14
173A—Chap. Speakers Travel	1,403.58	2,000.00		596.42
173B—Chapter Conference Committee Travel	4,723.71	5,000.00		276.29
173C—Chapter Relations Committee	548.82	600.00		51.18
175—Building Committee	2,806.37	3,000.00		193.63
201—ASA Membership Dues	100.00	100.00		—0—
204—Membership Certificates	664.68	1,000.00		335.32
205—Emblems	529.78	1,000.00		470.22
206—Medal and Awards	313.86	250.00	63.86	
	26,428.05	29,600.00	190.75	3,362.70
MEETINGS—SCHEDULE G				
163—Meetings	6,190.84	6,000.00	190.84	
327—Chapter Meeting Allowance	1,575.31	2,000.00		424.69
	7,766.15	8,000.00	190.84	424.69

PUBLICATIONS—SCHEDULE H				
200—JOURNAL Subscriptions	16,577.25	16,500.00	77.25	
202—TRANSACTIONS	12,870.92	24,500.00		11,629.08
203—Membership Roll	7,233.70	6,000.00	1,233.70	
208—Books, Reprints, Codes, Charts, etc.	1,619.77	2,200.00		580.23
305-325—GUIDE Publication and Distribution	70,897.41	70,000.00	897.41	
	109,199.05	119,200.00	2,208.36	12,209.31

HEADQUARTERS—SCHEDULE I				
210—Salaries	$ 63,822.79	$ 75,000.00	$	$11,177.21
210A—Social Security Taxes	394.18	1,000.00		605.82
211—Public Relations	5,836.03	5,500.00	336.03	
212—Travel—Secretary and Staff	2,945.93	3,800.00		854.07
213—Rent and Light	7,006.25	7,500.00		493.75
214—Telephone	1,939.84	2,000.00		60.16
215—Telegraph	658.78	600.00	58.78	
216—Postage	5,468.90	4,500.00	968.90	
217—Printing and Stationery	5,484.50	6,500.00		1,015.50
219—Addressing and Address Changes	528.16	500.00	28.16	
220—Professional Services ..	2,678.32	3,000.00		321.68
221—Bank Charges	50.60	100.00		49.40
222—Insurance	821.10	500.00	321.10	
11—Furniture and Fixtures	1,912.25	2,000.00		87.75
HEADQUARTERS—SCHEDULE (*Continued*)				
223—Office Expenses	1,864.99	2,000.00		135.01
224—Pension	1,085.07	1,000.00	85.07	
—Moving Expenses	5,500.00	5,500.00		
	107,997:69	121,000.00	1,798.04	14,800.35

RESEARCH—SCHEDULE J				
Research Committee Expenses	4,508.41	5,000.00		491.59
Staff Salaries	90,145.01	103,620.00		13,474.99
Laboratory Expenses	24,750.99	27,600.00		2,849.01
Laboratory Operations and Maintenance	6,958.27	9,100.00		2,141.73
Cooperative Contracts	21,020.02	22,500.00		1,479.98
Navy Research	23,440.35	29,380.00		5,939.65
	170,823.05	197,200.00		26,376.95

FUND RAISING—SCHEDULE K				
Salaries	7,463.08	9,000.00		1,536.92
Travel	813.95	1,500.00		686.05
Printing	2,282.67	2,250.00	32.67	
Exhibit at Exposition	285.30	500.00		294.70
Postage and Miscellaneous ..	1,389.24	1,250.00	139.24	
	12,154.24	14,500.00	171.91	2,517.67
TOTAL DISBURSEMENTS	$434,368.23	$489,500.00	$ 4,559.90	$59,691.67

The first technical paper, "Venting Hot Water Heating Systems," by Dr. F. E. Giesecke (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, November, 1951) was presented by Carl H. Flink, technical secretary, due to the inability of Dr. Giesecke to attend the meeting.

A prepared discussion was given by D. L. Mills, Rome, N.Y., and additional comments were made by W. M. Wallace II, Durham, N.C.; H. A. Lockhart, Morton Grove, Ill.; and H. M. Nobis, Cleveland, Ohio.

The second technical paper, "Self-Charging Electrostatic Filters," by W. T. Van Orman and H. A. Endres (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January, 1952) was presented by Mr. Van Orman. A written discussion prepared by A. B. Hubbard, Bloomfield, N. J., was read by Mr. Flink, and prepared discussions were presented by C. B. Rowe, Madison, Wis.; Lester T. Avery, Cleveland, Ohio; Arthur Nutting, Louisville, Ky.; and W. M. Myler, Jr., Columbus, Ohio. Following the discussion, Mr. Van Orman commented briefly.

President Seeley expressed his appreciation to the authors and the discussers, and adjourned the meeting at 4:30 p.m.

SECOND SESSION, TUESDAY, JANUARY 29, 9:30 A.M.

First Vice Pres. Ernest Szekely called the meeting to order at 9:30 a.m. in the Ballroom of the Hotel Statler, and asked Mr. Moon, chairman of the Inspectors of Election, to present the report which follows:

Report of Inspectors of Election

BALLOT FOR OFFICERS:	Total
President	
Ernest Szekely, Milwaukee, Wis. .	1537
First Vice President	
Reg F. Taylor, Houston, Tex. ...	1539
Second Vice President	
L. N. Hunter, Johnstown, Pa. ...	1534
Treasurer	
J. Donald Kroeker, Portland, Ore.	1538
MEMBERS OF COUNCIL (*three-year term*)	
M. K. Fahnestock, Urbana, Ill.	1538
P. B. Gordon, New York, N.Y.	1539
R. T. Kern, Fitchburg, Mass.	1539
D. M. Mills, Houston, Tex.	1536
COMMITTEE ON RESEARCH (*three-year term*)	
I. W. Cotton, Indianapolis, Ind.	1537
W. A. Grant, Syracuse, N.Y.	1538
N. B. Hutcheon, Ottawa, Canada	1539
B. H. Jennings, Evanston, Ill.	1539
C. O. Mackey, Ithaca, N.Y.	1538

Total Ballots Received	1663
Total Legal Ballots	1539
Invalid Ballots	124

Scattering votes: President 2; 2nd Vice President 5; Treasurer 1; Council 5; and Committee on Research 4.

Votes for Amendments to By-Laws	Yes	No
1. Art. II, Sec. 3 (*d*) Members ..	1517	22
2. Art. II, Sec. 3 (*e*) Junior Members	1517	22
3. Art. II, Sec. 3 (*b*) Student Members	1516	23
4. Art. II, Sec. 4, Privileges and Limitations	1531	8
5. Art. II, Sec. 7, Resignation	1533	6
6. Art. II, Sec. 8, Non-payment of dues	1530	9
7. Art. IV, Sec. 3, Dues	1532	7
8. Art. IV, Sec. 4, Dues to constitute subscriptions	1531	8
9. Art. VII, Sec. 3 (*c*) Guide Committee	1532	7
10. Art. VII, Sec. 3 (*f*) Chapter Relations Committee ...	1532	7
11. Art. VII, Sec. 3 (*b*) Committee on Research	1533	6
12. Art. VII, Sec. 3 (*i*) Public Relations	1534	5

Respectfully submitted,
L. WALTER MOON, *Chairman*
C. H. MCGUINESS
J. J. BECHTOL

I. W. Cotton, chairman of the Committee on Research, presented his report for the year 1951.

SPRING LAKE NEXT
Semi-Annual
Meeting 1952
June 16-18
at
The Essex & Sussex
Spring Lake, N. J.

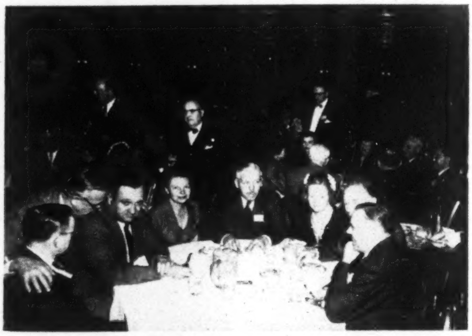
J. W. Cooper says welcome

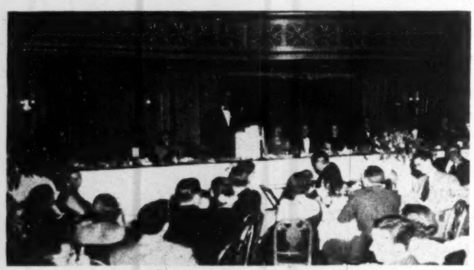
President Seeley says thank you

Announcements by B. L. Evans, general chairman

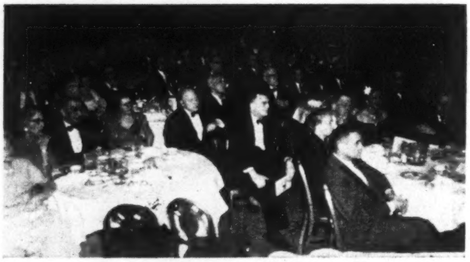
"Bill" Veeck wants a pennant

Monday night (*l.* to *r.*) C. M. Humphreys, Cyril Tasker, R. S. Dill, Mrs. Wallace, J. H. Fox, Mrs. Ince, F. E. Ince, W. M. Wallace, II





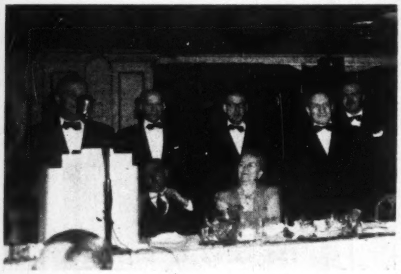
E. E. Carlson, Banquet toastmaster



Some of the 600 at the Banquet

S. R. Lewis receives F. Paul Anderson Medal from Lester T. Avery

M. F. Blankin presents Past President's Emblem to Dean Seeley



President Seeley introduces new Officers, J. D. Kroeker, Treasurer, Reg F. Taylor, 1st Vice Pres., Ernest Szekely, Pres., and L. N. Hunter, 2nd Vice Pres.

1951 Annual Report — Committee on Research

I. W. Cotton, Chairman

I. W. Cotton
Chairman

Committee on Research: Irwin W. Cotton, *Chairman;* R. S. Dill, *Vice Chairman;* Cyril Tasker, *Director of Research.*

Three Years: A. B. Algren, John Everetts, Jr., T. H. Smoot, Thomas A. Walters, William N. Witheridge.

Two Years: Carl F. Boester, Robert C. Cross, Richard S. Dill, Arthur J. Hess, Harold A. Lockhart.

One Year: Irwin W. Cotton, Nathaniel Glickman, Walter A. Grant, L. N. Hunter, Richard D. Madison.

Executive Committee: Irwin W. Cotton, *Chairman;* R. S. Dill, *Vice Chairman;* A. B. Algren, R. C. Cross, H. A. Lockhart.

R. S. Dill
Vice Chairman

Society Research during 1951 was concerned with a total of 20 projects at the Laboratory and 14 projects, or studies, at cooperating institutions, as follows:

Laboratory Projects

Panel Heating and Cooling

1. Completion and instrumentation of Environment Laboratory.
2. Investigation of heat exchange between a floor or ceiling panel and other room surfaces and the air in the space.
3. Field studies on heat losses from concrete floor slabs.
4. Laboratory studies on heat flow from plaster panels.
5. Analogue studies on concrete slabs laid directly on the ground.

Solar Heat Gain and Shading Effects

6. The effects of shades on reducing solar heat gain.
7. Film coefficients for low air velocities.
8. Radiant energy emission of atmosphere and ground.
9. Design data for figured glass.

Air Distribution

10. The fundamentals of ventilation jet behavior.
11. Isothermal and chilled jets discharging into a large space.
12. Turbulence in isothermal movement.
13. Development of turbulence intensity indicator.
14. Development of velocity direction probe.
15. Smoke filament techniques to determine velocity direction.

Human Calorimetry (O.N.R. Contract)

16. The construction and operation of a calorimeter and auxiliary equipment for the study of heat exchange between the human body and its environment.

Odors

17. The construction, equipping and instrumentation of two odor-free test rooms for studies on the relationship of the principal physical characteristics of air to the development and perception of odors of varying types and levels.

Heat Storage (Cooling Loads)

18. The use of thermal circuits in the study of factors influencing the instantaneous load on an air conditioning system.

Air Cleaning

19. The development of standard methods for the testing and rating of air cleaning devices used in general ventilation.

Sorbents

20. Field studies of test methods for sorption-type dehumidifiers.

Cooperative Projects

Air Distribution

1. Air flow from ceiling outlets.
2. Downward projection of heated air streams.
3. Friction in rectangular branch takeoff fittings.

Building Materials

4. Water vapor permeance of building materials.

Heat Pump

5. Thermally actuated moisture migration in granular-media.
6. Solar energy as a potential heat source for heat pump installations.

Panel Heating

7. Field studies on the control of panel heating systems.

Hot Water and Steam Heating

8. Noise in piping systems.
9. Air elimination in hot water heating systems.

Physiological Research

10. Physiological adjustments to changes in atmospheric environment.

Cooling Loads

11. The sol-air thermometer and sol-air temperature concept.

Industrial Ventilation

12. Local exhaust ventilation for control of atmospheric contaminants.

Air Conditions and Plant Growth

13. The role of air conditions in plant growth and reproduction.

Heating Loads

14. The measurement of rate of air change in rooms by the tracer-gas technique.

Environment Laboratory

The outstanding accomplishment at the Laboratory in 1951 was the substantial completion of the Environment Laboratory, the inauguration of the first studies with which it will be concerned, and the Open House marking the event.

The decision to build an Environment Laboratory was reached more than two years ago. Work on the preliminaries of construction began late in 1949, and the room was completed in its present form in time for the official opening on November 1, 1951. Details of the room, its construction, and its special features are covered in a paper* presented at the 58th Annual Meeting in St. Louis.

During the two years from November 1, 1949, to October 31, 1951, costs for labor, materials, equipment and general expenses on this room totalled approximately $76,500. Of this about $25,000 covered materials and equipment, and $51,500 covered direct labor and general expenses.

Presented at the 58th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, St. Louis, Mo., January 1952.

*The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee, and L. F. Schutrum (pp. 119-128, this issue.)

This new facility entailed a great deal of development work. For example, no one had ever used heat-flow meters on such a large scale to give detailed measurements of heat flow between the surface of any panel, the surrounding surfaces and the air of the enclosure. Novel features were introduced in instrumentation and measurement. It was not feasible to turn much of the work over to outside contractors. Members of the Laboratory staff working under close supervision did the planning and most of the actual construction.

The Society had needed facilities of this type ever since the Laboratory was moved from Pittsburgh. Its outstanding usefulness in needed and practical research can be judged by the fact that a request for the use of these facilities has already been made by the TAC on Sensations of Comfort, while suggestions for its possible use in their programs have come from several other technical advisory committees.

The exploratory tests made since the official opening exceed expectations; the TAC on Panel Heating and Cooling, which is concerned with the present series of studies, is reviewing the results during this meeting. The staff finds the room easy to operate. It will be used during 1952 to maximum capacity on programs developed by the staff with the counsel and guidance of the TAC on Panel Heating and Cooling.

Navy Calorimeter

The Navy calorimeter excited great interest during Open House. The calorimeter itself was on display, almost in its final form. The supporting equipment, mechanism, piping, and wiring commanded further attention.

The project of building this equipment has been a major challenge to the Laboratory Staff; very little work of a similar nature had ever been done before, so that the basic ideas translated into workable facilities represented a major research project.

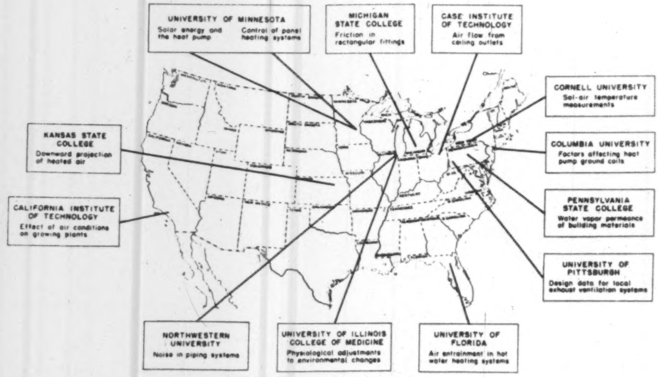

UNIVERSITY OF MINNESOTA
Solar energy and the heat pump
Control of panel heating systems
MICHIGAN STATE COLLEGE
Friction in rectangular fittings
CASE INSTITUTE OF TECHNOLOGY
Air flow from ceiling outlets
CORNELL UNIVERSITY
Sol-air temperature measurements
KANSAS STATE COLLEGE
Downward projection of heated air
COLUMBIA UNIVERSITY
Factors affecting heat pump ground coils
CALIFORNIA INSTITUTE OF TECHNOLOGY
Effect of air conditions on growing plants
PENNSYLVANIA STATE COLLEGE
Water vapor permeance of building materials
UNIVERSITY OF PITTSBURGH
Design data for local exhaust ventilation systems
NORTHWESTERN UNIVERSITY
Noise in piping systems
UNIVERSITY OF ILLINOIS COLLEGE OF MEDICINE
Physiological adjustments to environmental changes
UNIVERSITY OF FLORIDA
Air entrainment in hot water heating systems

Fig. 1—ASHVE Cooperative Research 1951

Open House

The Open House was held November 1 and 2, 1951. The program has been published,† together with full reporting of activities.

The entire staff at the Laboratory participated, each individual member having a specific assignment in welcoming visitors and showing full details of all matters of current interest in Society research activities.

Cooperative Research

Some time ago Council recommended to the Committee on Research that cooperative research and the establishment of research fellowships should be expanded. The breadth of the program adopted by the Committee in compliance can be seen in Fig. 1 which shows the location of the institutions now cooperating with the Society, and the type of study each is making. Research fellowships are presently in force at Case Institute of Technology, Cleveland; Pennsylvania State College, State College, Pa.; the University of Minnesota, Minneapolis; the California Institute of Technology, Pasadena; and the University of Pittsburgh.

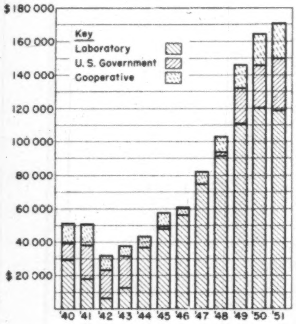


Fig. 2—Research expenditures 1940-1951

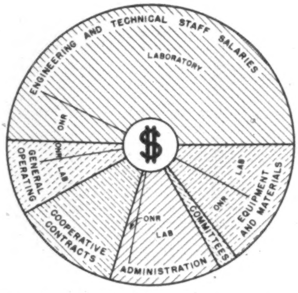


Fig. 3—Division of research expenses 1951

Three institutions, namely Northwestern University, Evanston, Ill., the University of Pittsburgh, and the California Institute of Technology, have been added during the year. Studies at Northwestern have been under way for more than half the year, studies at the other two are just now getting under way. The project at California Institute of Technology is a new field of interest for the Society.

Further expansion of cooperative research, or even the continuation of the present program, will involve difficulties which are already being encountered in finding men available and willing to do post-graduate research in the colleges. The demands of the armed forces and the defense program have dipped deeply into the pool of manpower that might be available for this type of work, and there is an increasing scarcity of engineering graduates. In spite of this situation, the Committee on Research will give continuing attention to the desirable objective of making cooperative research increasingly attractive to the right type of men in the colleges.

This same problem also faces the Committee with regard to the Laboratory. Four graduates have been lost from the Laboratory Staff during the past year to the armed services or to industry, and it becomes more of a problem each year to attract young engineers into research institutions of the type of the Society's Research Laboratory. Fortunately the Committee has been able to retain the services of key personnel and has obtained, through the cooperative plan of Fenn College in Cleveland, the services of a number of men in their junior and senior years of college.

Research Expenditures

My predecessor, in the Annual Report for 1950, reviewed research operations for the previous decade. The consistent growth which he reported there has been main-

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†New ASHVE Environment Laboratory Inaugurated (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1951, pp. 120-125.)

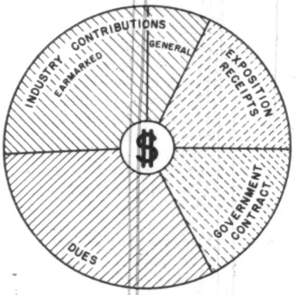


Fig. 4—Sources of research income 1951

tained during 1951, as indicated in Fig. 2. Total expenditures were $170,820, and Fig. 3 shows how this total is made up. Direct grants for cooperative research and research fellowships in 1951 totalled over $21,000. This is the highest figure in the history of Society research.

Expenditures for staff salaries represent 59 percent of the total research expenditures including cooperative research grants, and 67-½ percent of the total expenditures when these are excluded. These figures compare favorably with those of a number of other research institutions.

In several large research institutions over the past few years, budgets for research programs have been analyzed on the basis of *cost per overall person.* The resulting figures have ranged between $5000 and $7500, depending on the size of the institution and type of work undertaken, with an average of around $6300. Analyzed on the same basis, the overall costs of the Society's research operations in 1951 were $5970 per person when cooperative research grants are excluded, and $6800 when they are included. Cooperative research is not carried on without overhead costs for organization and administration, review of results by responsible committees, and the publication of the results of the studies.

Research Income

Fig. 4 shows the breakdown of research income for 1951. Dues income is the foundation stone on which all research operations are built, but it would be unfair to all those organizations and individuals in the industry who have participated in the research program in 1951 to minimize in any way the importance and value of their support. Cloud Wampler, president of the Carrier Corp., Syracuse, N. Y., made the following remarks at the inauguration of the Environment Laboratory regarding industry support, financial and technical, of the Society's research program:

At least 1.5 cents of each of the sales dollars in the air conditioning and refrigeration part of our industry is plowed back into research of one type or another . . . . . In this area alone the investment in research was just short of $10,000,000. If to this we add other research that is of direct benefit to us, we could guess quite plausibly that the total research bill comes somewhere near $20,000,000 annually . . . . . The great bulk of this goes into product and process development . . . . . This is exactly as it should be.

However, the question I would raise directly with you is whether we are spending enough money on long-range fundamental and applied research of a type which will perpetuate and benefit the entire industry. True, some of this work is now being carried on by individual companies as part of their contribution to the future. But there are many fine companies which cannot afford to do this, nor put the proper talent to work on it, nor provide the proper atmosphere for such work—an atmosphere which should be reasonably free from commercial pressures.

The entire program for the ASHVE Laboratory in 1952 will cost less than $200,000. And industry will contribute less than 40 percent of this sum. So at present the Laboratory is costing our industry only about one-hundredth of one percent of the sales volume of air conditioning and commercial and industrial refrigeration equipment alone, and represents only about four-tenths of one per cent of the total amount invested each year in research in the field of heating, ventilating and air conditioning.

Gentlemen, I submit to you that *we should be spending a great deal more on fundamental research. And I say to you, this is not an expense. It is an investment — an investment in our own future.*

However, it is still not enough for us to say, *Here's the money — go to it!* We also must make adequate contributions of the time of our best engineering people to assure the success of the program. Good technical brains are needed on the advisory committees and on panels to advise as to how and where the money should be spent.

As to value received, there simply is no question about it. I know that fundamental research sometimes seems to move very slowly. Perhaps it does. But no intelligent person can expect basic results to be achieved on a time-table basis. And you have only to look back over the years to see what extremely valuable data have come out of ASHVE research alone.

Operational Guide

The outstanding accomplishment of the Committee on Research during 1951 was the completion of the Operational Guide for submission to Council; outlining its own procedures and those of the Technical Advisory Committees. This work was necessitated because of the adoption of the new Society Charter and By-Laws, but even if this requirement had not arisen, the time had arrived for research operations to be systematized and better coordinated into the Society's other activities.

This Operational Guide sets up general procedures governing the respective duties

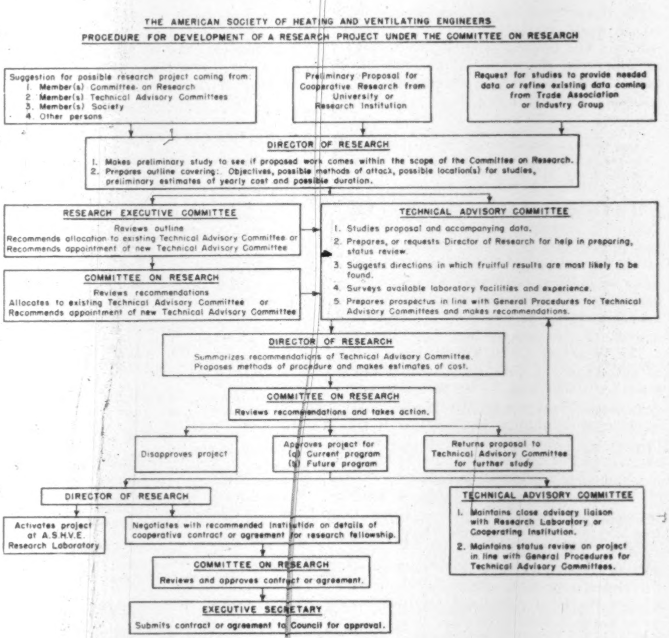

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
PROCEDURE FOR DEVELOPMENT OF A RESEARCH PROJECT UNDER THE COMMITTEE ON RESEARCH
Suggestion for possible research project coming from: 1. Member(s) Committee on Research 2. Member(s) Technical Advisory Committees 3. Member(s) Society 4. Other persons
Preliminary Proposal for Cooperative Research from University or Research Institution
Request for studies to provide needed data or refine existing data coming from Trade Association or Industry Group
DIRECTOR OF RESEARCH
1. Makes preliminary study to see if proposed work comes within the scope of the Committee on Research.
2. Prepares outline covering: Objectives, possible methods of attack, possible location(s) for studies, preliminary estimates of yearly cost and possible duration.
RESEARCH EXECUTIVE COMMITTEE
Reviews outline
Recommends allocation to existing Technical Advisory Committee or Recommends appointment of new Technical Advisory Committee
COMMITTEE ON RESEARCH
Reviews recommendations
Allocates to existing Technical Advisory Committee or Recommends appointment of new Technical Advisory Committee
TECHNICAL ADVISORY COMMITTEE
1. Studies proposal and accompanying data.
2. Prepares, or requests Director of Research for help in preparing, status review.
3. Suggests directions in which fruitful results are most likely to be found.
4. Surveys available laboratory facilities and experience.
5. Prepares prospectus in line with General Procedures for Technical Advisory Committees and makes recommendations.
DIRECTOR OF RESEARCH
Summarizes recommendations of Technical Advisory Committee.
Proposes methods of procedure and makes estimates of cost.
COMMITTEE ON RESEARCH
Reviews recommendations and takes action.
Disapproves project
Approves project for (a) Current program (b) Future program
Returns proposal to Technical Advisory Committee for further study
DIRECTOR OF RESEARCH
Activates project at A.S.H.V.E. Research Laboratory
Negotiates with recommended institution on details of cooperative contract or agreement for research fellowship.
COMMITTEE ON RESEARCH
Reviews and approves contract or agreement.
EXECUTIVE SECRETARY
Submits contract or agreement to Council for approval.
TECHNICAL ADVISORY COMMITTEE
1. Maintains close advisory liaison with Research Laboratory or Cooperating Institution.
2. Maintains status review on project in line with General Procedures for Technical Advisory Committees.

Fig. 5—Research project procedure chart

JOURNAL SECTION

ASHVE RESEARCH IN COOPERATING INSTITUTIONS

California Institute of Technology, Pasadena, Cal.: (Research Fellowship) The Role of Air Conditions in Plant Growth, Plant Reproduction and Photosynthesis.

Case Institute of Technology, Cleveland, Ohio: (Research Fellowship) Air Flow from Annular Slots, Ceiling Plaques and Circular Diffusers.

Columbia University, New York, N.Y.: The Investigation of Thermally Actuated Moisture Migration in Granular Media. (Heat Pump)

Cornell University, Ithaca, N.Y.: The Sol-Air Thermometer and the Sol-Air Temperature Concept.

University of Florida, Gainesville, Fla.: Air Entrainment in Hot Water Heating Systems.

University of Illinois, College of Medicine, Chicago, Ill.: The Physiological Adjustments made by Healthy and Physically Impaired Persons to Rapid Changes in Atmospheric Environment.

Kansas State College, Manhattan, Kan.: The Downward Projection of Heated Air Streams.

Michigan State College, East Lansing, Mich.: Friction in Rectangular Branch Take-Off Fittings.

University of Minnesota, Minneapolis, Minn.:
- (a) Solar Energy as a Potential Heat Source for Heat Pump Installations.
- (b) (Research Fellowship) — Field Studies on the Control of Panel Heating Systems.

Northwestern University, Evanston, Ill.: Noise in Piping Systems.

Pennsylvania State College, State College, Pa.: (Research Fellowship) — The Water Vapor Permeance of Building Materials.

University of Pittsburgh, Pittsburgh, Pa.: (Research Fellowship) — Design Requirements of Local Exhaust Ventilation for Control of Atmospheric Contaminants Released by Hot Industrial Processes.

and responsibilities of the Chairman, the Committee on Research, the Technical Advisory Committees and the Director of Research. It outlines in some detail the steps for the development of a research project under the Committee on Research (Fig. 5) and endeavors to insure that all serious suggestions for worth-while projects receive careful study, and that no project is undertaken unless it has received a thorough screening by the responsible committees.

The Operational Guide represents painstaking work on the part of many individuals. The Committee on Research took cognizance of the efforts of one member particularly, W. A. Grant, passing the following resolution:

> THAT a vote of thanks be extended to Mr. Grant for the fine work done in drafting the Operational Guide for the Technical Advisory Committees.

The Technical Advisory Committees for 1952 will be named to include academic and professional personnel, manufacturers in the industry, representatives of large users of heating, ventilating and air conditioning equipment, and also individual members of the Society having particular interest in the work of any committee.

The Technical Advisory Committees will be authorized and encouraged to hold four meetings each year: at the Society's Annual and Semi-Annual Meetings as heretofore, and in addition two meetings to be held at the Laboratory or at the cooperating institution representing the scene of the committee's principal interest.

Continuous effort will be made to keep each of these Technical Advisory Committees at a point of maximum strength and activity. *The wealth of knowledge available to research through these committees represents a priceless asset and must be utilized to fullest advantage.* Suggestions as to possible nominations for these committees are invited from chapters, from industry, from the profession, and from the membership at large. Each Technical Advisory Committee will participate directly in the activities under its cognizance with the result that our research program will inevitably gain in accuracy, timeliness, and overall effectiveness.

Liaison with Chapters and Entire Society Membership

Membership interest in Society research has been growing and manifests itself in the increasing willingness of chapters and individual members to assist in research work.

Two years ago the chapters offered their services in connection with field tests authorized by the Committee on Research under proper regulation and supervision, and such activities are planned in connection with early programs.

In order that chapters may know first hand about the up-to-the-minute progress of Society research a series of slides have been prepared and will be made available, through the Executive Secretary, for chapter meetings, and the services of individual members of the Committee on Research are offered in this same connection. Full presentations of research activities are available to chapters whenever requested.

In 1948 a survey of membership interest in the type of program most desirable for Society research was conducted with some 1100 replies and comments from interested members. The information developed by this survey became the basis of the long-range research program adopted by the 1950 Committee on Research which became the base of our activities. The 1951 Committee on Research voted to conduct another survey, and R. C. Cross, who was Chairman of the 1948 Survey Committee, has been asked to be chairman of the new survey which will be carried forward to completion during 1952.

Those directly connected with the Society's research program recognize our obligation to the Society membership which provides the funds that are the important base of our research expenditures. It is anticipated that the entire membership will also appreciate and utilize the opportunity for contribution, not only of the dollars which they give, but the even more valuable fund of information and experience which can add immeasurably to the furtherance of the Society's research program.

Acknowledgement

As chairman it is my privilege to acknowledge the fine contributions in time and effort made by the Committee on Research and the Technical Advisory Committees during 1951. Five meetings of the Committee on Research were held with a total attendance of 60 members and nine guests. During the year covered by this report 29 meetings of Technical Advisory Committees were held, many of them at the Laboratory and two of them each lasting two days. The total attendance was over 270 members and 200 guests.

The officers of the Society, members of Council and of Society Committees, and countless individual members generously supported our 1951 efforts and have earned the gratitude of all of us working in the interest of Society research. The cooperation extended to me personally throughout the year will always be remembered with pleasure and sincere gratitude. My thanks also go to the Director of Research, and his entire staff not only for faithful service in line of regular duty, but for extraordinary efforts and achievements in preparing for our Open House and taking part as hosts when we welcomed the friends who responded to our cordial invitation to visit us.

RESEARCH PAPERS — 1951

1. Barometric Draft-Control Analysis, by H. B. Nottage, D. W. Locklin, and R. G. Huebscher (Cleveland, Ohio) (June 1951, JOURNAL SECTION).
2. Laboratory Studies of the Thermal Characteristics of Plaster Panels, by C. M. Humphreys, C. V. Franks, and L. F. Schutrum (Cleveland, Ohio) (July 1951, JOURNAL SECTION).
3. The Control of Air Streams from a Long Slot, by Alfred Koestel and Chia-Yung Young (Cleveland, Ohio) (July 1951, JOURNAL SECTION).
4. Radiant Energy Emission of Atmosphere and Ground: A Design Factor in Heat Gain and Heat Loss, by G. V. Parmelee and W. W. Aubele (Cleveland, Ohio) (November 1951, JOURNAL SECTION).
5. Physiological Adjustments of Clothed Human Beings to Sudden Change in Environment; First Hot Moist and Later Comfortable Conditions, by Ford K. Hick, M.D., Tohru Inouye, Robert W. Keeton, M.D., Nathaniel Glickman, Maurice K. Fahnestock (Chicago, Illinois) (February 1952, JOURNAL SECTION).
6. Isothermal Ventilation-Jet Fundamentals, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (Cleveland, Ohio) (January 1952, JOURNAL SECTION).
7. The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee, and L. F. Schutrum (Cleveland, Ohio) (March 1952, JOURNAL SECTION).
8. A V-Wire Direction Probe, by H. B. Nottage, J. G. Slaby and W. P. Gojsza (Cleveland, Ohio) (April 1952, JOURNAL SECTION).

Following the report by Mr. Cotton, Cyril Tasker, Director of Research, gave an abstract of the paper, "The ASHVE Environment Laboratory," by Mr. Tasker, C. M. Humphreys, G. V. Parmelee, and L. F. Schutrum (see page 119).

The second paper, "A V-Wire Direction Probe," by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (to be published in the ASHVE Journal Section, *Heating, Piping & Air Conditioning*, April, 1952) was presented by Mr. Nottage.

The third paper, "Radiant Energy Emission of Atmosphere and Ground: A Design Factor in Heat Gain and Heat Loss," by G. V. Parmelee and W. W. Aubele (published in ASHVE Journal Section, *Heating, Piping & Air Conditioning*, November, 1951) was given in abstract by Mr. Parmelee.

The fourth paper, "Isothermal Ventilation-Jet Fundamentals," by H. B. Nottage, J. G. Slaby, and W. P. Gojsza (published in ASHVE Journal Section, *Heating, Piping & Air Conditioning*, January, 1952) was presented by Mr. Nottage.

A prepared discussion was given by G. L. Tuve, Cleveland, Ohio. Comments on the paper were made by S. F. Gilman, Urbana, Ill.; R. A. Miller, Pittsburgh, Pa.; W. A. Danielson, Raleigh, Tenn.; E. K. Campbell, Kansas City, Mo.; and H. H. Reich, Pittsburgh, Pa. A written discussion has been received since the meeting from C. M. Ashley, Syracuse, N. Y.

Vice President Szekely thanked the authors and discussers, and adjourned the session at 12:00 noon.

THIRD SESSION, TUESDAY, JANUARY 29, 2:00 P.M.

President Seeley called the third technical session to order at 2:00 p.m., and announced the appointment of a Resolutions Committee: E. L. Crosby, Baltimore, Md., *chairman;* P. J. Marschall, Chicago, Ill.; and B. W. Farnes, Portland, Ore.

Symposium

After making an announcement that the session would be a Symposium on the subject, *The Industrial Atmosphere*, President Seeley introduced W. N. Witheridge, Detroit, Mich., who acted as Moderator of the session.

Dr. Witheridge stated that the object of the session was to contribute to a better understanding and better communication between engineers, the medical profession, and the general public in matters pertaining to ventilation problems in the industrial field. He stated that the subject would be presented from four viewpoints as represented by, (1) the industrial engineer who must reconcile many conflicting requirements, (2) the industrial architect who must find space for an increasing quantity of equipment and who must also specify the architectural requirements in regard to the appearance of the structure, (3) the equipment supplier who must translate somewhat rigid requirements into practical and economical equipment, and (4) those who work and live near the industrial operations and who are consequently affected by the atmospheric conditions with regard to air pollution.

H. A. Mosher, Rochester, N. Y., spoke on the *Integration of Process and Human Requirements.*

A discussion of the *Effect of Atmospheric Requirements on Industrial Architecture and Plant Layout* was prepared by A. T. Waidelich and W. A. Hunting, both of Cleveland, Ohio, and was presented by Mr. Waidelich.

R. P. Warren, Buffalo, N. Y., whose subject was *Equipment for Industrial Ventilation and Air Pollution Control*, gave an analysis of the manufacturers' approach to the solution of problems involving cleaning of air and prevention of air pollution.

The Effects of the Industrial Atmosphere on Workers and on the Community were discussed by R. A. Kehoe, M.D., Cincinnati, Ohio. Dr. Kehoe pointed out that while much information has been collected in the fields of industrial physiology, industrial toxicology, and industrial medicine on the effects of unfavorable physical and chemical conditions on the occupants of industrial plants, there has not yet been corresponding progress in relating air pollution to the health of the members of the community. He also discussed the practical approach to the prevention of air pollution.

Chairman Witheridge invited the audience to participate in the discussion, and stated that the members of the panel would be glad to answer questions.

Comments were made by John H. Clarke, Chicago, Ill.; Philip Cohen, Boston, Mass.; John M. Kane, Louisville, Ky.; H. G. Dyktor, Cleveland, Ohio; F. N. Calhoon, Ann Arbor, Mich.; and H. E. Ziel, Detroit, Mich. Replies to the questions raised and further comments were given by the panel members.

Moderator Witheridge, in some concluding remarks, stated that the symposium had brought out the need for cooperation and consultation between those who are concerned with individual problems in the industrial ventilation field. Such cooperation and close contact between all those concerned with environmental conditions in industry and with means for providing proper conditions, would prevent the making of many costly mistakes.

A complete report on the Symposium, together with the discussions, will be published in ASHVE Journal Section, *Heating, Piping & Air Conditioning*, April, 1952.

President Seeley remarked that the Symposium was an example of the work of a Technical Advisory Committee of the Society. He pointed out that the promotion of very extensive research was made possible by the activities of this and many other Technical Advisory Committees of the Society, and also by the contributions from a portion of members' dues. President Seeley thanked Dr. Witheridge and the members of the panel for their splendid presentation of the various subjects.

The meeting was adjourned at 5:00 p.m., after which the audience remained to view the film, *Exhaust Hoods, Their Design and Application.* The film, which depicted the principles and application of exhaust ventilation, had been prepared jointly by collaboration of Prof. A. B. Eppel of the University of Michigan, K. E. Robinson, Division of Industrial Health, Michigan Department of Health, Lansing, Mich., and John M. Kane, Dust Control Division, American Air Filter Co., Louisville, Ky.

FOURTH SESSION, WEDNESDAY, JANUARY 30, 9:30 A.M.

Second Vice President Taylor called the meeting to order at 9:30 a.m. and asked V. C. Salazar, project manager of the Mutual Security Agency, Washington, D.C., to introduce a study group of manufacturers from France who were visiting the United States as follows:

C. E. Schaeffer (Leader), J. Sohn, both of Mertzwiller (Bas-Rhin); M. Arnould, Haybes (Ardennes); J. J. Chretien, C. E. LeFevre, both of Guise (Aisne); P. Cochard, Charleville (Ardennes); C. E. Frerot, Bevin (Ardennes); M. M. Houe, Rosieres par Lunery (Cher); P. H. Mabille, Paris; L. P. Magdelenat, Lunery (Cher); J. P. Meura, Merville (Nord); and F. J.-L. Paulus, Niort (Deux-Sevres).

Mr. Salazar stated that his group was sponsored by the Marshall Plan Agency for the purpose of studying new production techniques in foundries and sheet metal industries producing radiators, boilers, gas ranges and space heaters.

All members of the group had found their visits to American plants very informative and stimulating.

The first paper, "Gas is an Important Factor in the Thermal Conductivity of Most Insulating Materials," by F. B. Rowley, R. C. Jordan, C. E. Lund, and R. M. Lander (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning,* December, 1951) was presented by Professor Rowley. A prepared discussion was given by R. S. Dill, Washington, D. C., and additional comments were made by W. A. Danielson, Raleigh, Tenn.; H. M. Nobis, Cleveland, Ohio; N. B. Hutcheon, Ottawa, Canada; and G. V. Parmelee, Cleveland, Ohio.

The second paper, "Thermal Performance of Frame Walls," by G. O. Handegord and N. B. Hutcheon (see page 113) was presented by Dr. Hutcheon. A written discussion received from G. B. Wilkes, Cambridge, Mass., was read by Mr. Flink. A discussion prepared by F. A. Joy, State College, Pa., was read by Prof. E. R. Queer. Additional prepared discussions were given by F. B. Rowley, Minneapolis, Minn., and P. R. Achenbach, Washington, D.C.

Chairman Taylor then recognized L. W. Cotton, chairman of the Committee on Research, who requested A. J. Hess, Los Angeles, Cal., chairman of a new TAC on Heating and Air Conditioning as Related to Plant and Animal Husbandry, to make a statement about the objectives of the committee. Mr. Hess stated that this Committee was concerned with the effect of air conditioning on plant and animal growth, and he mentioned some of the work that had been done in the Phytotron at the University of California. He requested that Society members present make suggestions of names of members who would be interested in serving on this committee, and announced that such names should be sent to either Cyril Tasker or himself.

The third technical paper, "Physiological Adjustments of Clothed Human Beings to Sudden Changes in Environment: First Hot Moist and Later Comfortable Conditions," by F. K. Hick, M.D., Tohru Inouye, R. W. Keeton, M.D., Nathaniel Glickman, and M. K. Fahnestock (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning,* February, 1952) was presented by Dr. Hick. Discussions of the paper were given by Lester T. Avery, Cleveland, Ohio; W. A. Danielson, Raleigh, Tenn.; and M. K. Fahnestock, Urbana, Ill.

Chairman Taylor expressed his appreciation to the authors and discussers, whereupon the meeting was adjourned at 12:20 p.m.

FIFTH SESSION, WEDNESDAY, JANUARY 30, 2:00 P.M.

Pres. Lauren E. Seeley called the meeting to order at 2:00 p.m. in the Ballroom of the Statler Hotel, and announced that, as the three papers for the session were closely related, discussions would be given after all had been presented. He then introduced S. Konzo, Urbana, Ill., who gave an abstract of the paper, "Warm-Air Perimeter Heating, Part II — Temperature Drop in Ducts Embedded in Concrete Floors," by J. R. Jamieson, R. W. Roose, S. Konzo, and H. T. Gilkey (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning,* February, 1952).

Installation of Officers

The installation of the newly elected Officers and Council members was conducted by Past Presidents S. R. Lewis, Chicago, Ill., M. F. Blankin, Philadelphia, Pa., S. H. Downs, Kalamazoo, Mich., G. L. Tuve and Lester T. Avery, Cleveland, Ohio, and former Council member, W. A. Danielson, Raleigh, Tenn.

Mr. Avery introduced the newly elected Council members to Past President Lewis: R. T. Kern, Fitchburg, Mass., P. B. Gordon, New York City, D. M. Mills, Houston, Tex., Prof. M. K. Fahnestock, Urbana, Ill. Mr. Avery pointed out that they have not yet served the Society as officers, but have served it in many other capacities.

Mr. Lewis recalled his service as president 38 years ago and said that it was a great privilege to be associated in the installation ceremony. He said, "I have been a member of this organization a long time. I love the organization and I love the men in it and the fellowship that they have extended to me throughout the years. I congratulate you on being selected for service on the Council which runs this organization."

Mr. Avery presented the newly elected officers of the Society to Mr. Lewis as follows: J. Donald Kroeker, Portland, Ore., Treasurer; L. N. Hunter, Johnstown, Pa., Second Vice President; Reg F. Taylor, Houston, Tex., First Vice President; and Ernest Szekely, Milwaukee, Wis., President.

Mr. Lewis said, "We are honored that you have survived the sifting out process through the nominating committee, through the election, and through the toil and sweat of coming up here on this platform at last to honor the Society by your presence and your efforts.

You are honored by being selected by this organization to take over this job. Let it be understood that you are the leaders.

President Seeley, permit me to present to you the new Officers and the Council."

President Seeley thanked Mr. Lewis and his associates on behalf of the Society and all of the members and welcomed the new Officers and Council members.

He expressed his personal appreciation to the present Officers and Council, and sincere thanks to those who have left the Council: S. W. Boyd, Atlanta, Ga.; C. R. Gardner, Dallas, Tex.; J. Donald Kroeker, Portland, Ore., who has left the Council and appears now in a new capacity; H. E. Sproull, Cincinnati, Ohio, Treasurer; Prof. C. O. Mackey, Ithaca, N.Y., who joins the Committee on Research; and Lester T. Avery, Cleveland, Ohio.

President Seeley said that everybody had worked hard and that the men now seen would carry it on. He pointed out that the success of Society operations is largely dependent upon the generous and voluntary effort of so many people, and that we couldn't do these things otherwise.

An abstract of the second paper, "Warm Air Perimeter Heating, Part III — Heat Losses from Floor Slab," by J. R. Jamieson, R. W. Roose, and S. Konzo (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February, 1952) was presented by Mr. Jamieson.

The third paper, "Performance of a Warm-Air Radial-Feeder Perimeter Loop System in a Residence," by M. E. Childs, R. W. Roose, and S. Konzo (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February, 1952) was presented by Mr. Childs.

Following the third paper, discussions were presented by E. K. Campbell, Kansas City, Mo.; S. R. Lewis, Chicago, Ill.; F. E. Ince, St. Louis, Mo.; P. R. Achenbach, Washington, D.C.; G. O. Handegord, Saskatoon, Canada; G. L. Tuve, Cleveland, Ohio; J. T. Lynch, St. Louis, Mo.; D. L. Mills, Rome, N.Y.; M. K. Fahnestock, Urbana, Ill.; and E. B. Langenberg, St. Louis, Mo. Brief authors' closures for the three papers were given by Messrs. Jamieson and Childs.

President Seeley thanked the authors and discussers for providing a very interesting session.

The Report of the Committee on Resolutions was presented by E. L. Crosby, Baltimore, Md., and was adopted unanimously.

Resolutions

WHEREAS, For the 58th time THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has assembled in Annual Meeting and on this occasion has been fortunate in having as hosts the St. Louis Chapter of the Society and the fair City from which the Chapter derives its name; and

Under the able leadership of our President, Dean Lauren E. Seeley, the other Officers and the Staff of the Society, we have had outstandingly successful technical sessions; and

Under the planning and guidance of the team of Evans and Myers, Pres. L. L. Hamig, the other Officers of the St. Louis Chapter and their energetic and capable assistants from the Chapter, the social events have been more than enjoyable; and

With *Engineer* Bill Veeck displaying brown prints in lieu of the more subdued blue prints, the Welcome Luncheon was a masterpiece; and

With charm and grace pre-eminent, the fair ladies have been admirably cared for and entertained, therefore,

BE IT RESOLVED, That we express our sincere gratitude and thanks:

TO the St. Louis Chapter, its Officers and Committees, and to the magnificent Mound City for manifesting, "The Spirit of St. Louis" in organizing our activities, in warm friendship and hospitality and in superb entertainment,

TO the authors of the technical papers and to those who ably participated in the discussions,

TO the hotel managements of this great City for their facilities and services,

TO the St. Louis Convention and Publicity Bureau, Mr. Fred Rein, manager, for the housing and other services which have been so helpful in every way,

TO the daily press, the technical press and radio for their recognition of the importance of our Society, of our Annual Meeting and of our Society's contribution to the welfare, health and satisfaction of the public whom we serve,

TO *Engineer* Veeck with the sincere hope that he will be as successful in winning a pennant as he was in winning his audience, and

TO the authors of the native folk songs, as we have learned that "Meet Me in St. Louis" is an invitation preceding a royal welcome and that "The St. Louis Blues" is a musical composition concerning something which we have been unable to find.

Respectfully submitted,
THE RESOLUTIONS COMMITTEE
Bert W. Farnes, Portland, Ore.
Peter J. Marschall, Chicago, Ill.
Edward L. Crosby, *Chairman*,
Baltimore, Md.

President Seeley turned the gavel over to President-Elect Ernest Szekely with his best wishes.

President-Elect Szekely thanked Dean Seeley and promised that he would use the gavel in a proper manner at all times.

As there was no unfinished or new business, the 58th Annual Meeting was adjourned at 4:25 p.m.

We are indebted to William Wallace, II, Durham, N.C., for the page of snapshots showing the happenings during the 58th Annual Meeting.

Special Events

Entertainment features included a Welcome Luncheon attended by 485 members and guests at the Statler on Monday, with greetings from the St. Louis Chapter President, L. L. Hamig, and a response from Pres. Lauren E. Seeley for the Society. A very entertaining discussion on baseball management, *Engineering a Pennant*, was presented by William *Bill* Veeck, president of the St. Louis Browns. The Monday night *Meet Me in St. Louis* Party was a sellout with 700 members and guests in the Gold Room of the Hotel Jefferson. This party featured dinner and dancing and the *ASHeVErs Review of* 1952.

Tuesday night, 325 members and their wives visited the Anheuser-Busch plant, and following a tour of the various departments, they enjoyed an excellent buffet supper. Meanwhile 180 members and their guests saw two very fascinating movies at the Hotel Statler Ballroom presented by Edgar M. Queeney entitled *Prairie Wings* and *Sunrise Serenade.*

Banquet

The Annual Banquet attended by 590 members and guests was held in the Gold Room of the Hotel Jefferson with Ralph W. Carney, Wichita, Kans., speaking on *New Strength for America.* He told of America's great material and spiritual strength and the importance of each person doing his part to make his community a better place to help make a stronger America.

Prof. G. L. Tuve presented the Past President's Memory Book to

Lester T. Avery, Cleveland, Ohio, and the Past President's Emblem was presented to Dean Lauren E. Seeley by M. F. Blankin. The F. Paul Anderson Medal for 1950 was presented to Samuel R. Lewis, who had been unable to be at Philadelphia for the presentation in 1951, by Lester T. Avery. Dean Seeley announced the F. Paul Anderson Medal for 1951 had been awarded to Homer Addams and would be presented at the Philadelphia Chapter meeting on February 14.

For the ladies there was a Welcome Tea on Sunday with 125 in attendance; a discussion of precious stones on Monday; a Style Show and Luncheon at the Park Plaza Hotel on Tuesday; and a bus tour of St. Louis featuring a visit to the Missouri Botanical Gardens and luncheon at the Art Museum on Wednesday.

It was a very profitable and enjoyable four days for everyone attending the sessions and special events. The *Mound City* attained a new place in the hearts of all by its wonderful hospitality.

Committee Meetings

Many Society committees held meetings and among them were the Executive, Finance, Chapters Conference and Nominating Committees. The Committee on Research held two meetings and the following Technical Advisory Committees met: Air Distribution, Heat Flow through Glass, Combustion, Industrial Ventilation, Panel Heating and Cooling, Cooling Load, Heating Load, Weather Design Conditions, Heat Pump, Hot Water and Steam Heating, and Sorbents. There was also a meeting of the Heavy Duty Furnace group.

KROEKER & ASSOCIATES FORMED

The consulting engineering firm of J. Donald Kroeker, Failing Building, Portland, Ore., has been expanded by inclusion of nine engineering assistants as associates under the firm name of J. Donald Kroeker and Associates, according to a recent announcement. The associates are: J. H. Bonebrake, J. P. Byrne, R. C. Chewning, E. R. Hoerner, E. E. Kelly, Faruk Konuk, W. D. Maxwell, R. W. Peterson, and R. E. Selberg, all registered as professional engineers in Oregon and all are members of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

Mr. Kroeker's engineering office specializes in design of heating, ventilating, air conditioning, plumbing, and other equipment of buildings and of heating and power plants, and has been in practice since 1936 except for two and one-half years when Mr. Kroeker was in the military service. Listed in *Who's Who in Commerce and Industry* as designer of the two largest heat pump installations in this country, Mr. Kroeker has focussed international attention on Portland through his technical papers on heat pumps, which he presented before Society meetings.

Active in civic and technical circles, Mr. Kroeker was elected treasurer of ASHVE at the 58th Annual Meeting on January 28 and is a member of *The American Society of Mechanical Engineers, Society of American Military Engineers, Professional Engineers of Oregon*, and Rotary. He has served two years as chairman of Portland's Air Pollution Committee.

J. H. Bonebrake received his mechanical engineering training at Oregon State College. His experience includes a year in the technical department of the International Smelting Co. at Tooele, Utah; a year in plant engineering at Columbia Aircraft Co.; three years as plant engineer in the lumber laminating division of Timber Structurers, Inc.; and a year with A. G. Rushlight & Co. as superintendent of its heating contracting business. He has been employed by Kroeker since 1945.

Born in South Dakota, J. P. Byrne received his early schooling in Eugene public and high schools. He served as an Aviation Cadet with the Navy during World War II. He was graduated from Stanford University with a degree in mechanical engineering in 1949, was employed by Iron Fireman Mfg. Co., and has been with the consulting office since 1950.

R. C. Chewning, born in Grand Junction, Colo., was graduated from St. Mary's high school at Huber, Ore., and came to Portland in 1927. After 3 years of engineering at the University of Washington at Seattle, he joined Mr. Kroeker's staff in March, 1938. Inducted into the Army with the 41st Division in September, 1940, he was a captain with the Third Armored Division in the Battle of the Bulge, from which he returned wounded. He returned to the consulting office when it reopened in 1945. He was president of the Oregon Chapter of ASHVE in 1950.

E. R. Hoerner, born in Portland, attended the University of Portland and served with the Army in the Field Artillery in Europe. He was graduated from Oregon State College with an M.E. degree in 1947 and has been in Mr. Kroeker's employ since that time.

E. E. Kelly, a native of Oregon, served as First Lieutenant in aircraft maintenance in India and China. Formerly with Boeing Aircraft Co., he entered Mr. Kroeker's employ upon graduation from Oregon State College with an M.E. degree in 1947.

Faruk Konuk, born in Istanbul, obtained his B.S. degree in mechanical engineering at Robert (American) College of Istanbul in 1944. After some post graduate work at the University of California and six months of drafting at Oakland, he joined Mr. Kroeker's staff in August 1947.

W. D. Maxwell was reared and attended elementary school in Milwaukee, entered Oregon State College in 1940 and the military service in 1943. He was graduated in 1947 from Oregon State College, from which he entered his present employ.

A native of Washington, R. W. Peterson attended Oregon elementary schools and Oregon State College. His employment in 1942 with DeWitt C. Griffin and Associates, Seattle, consulting engineers, was interrupted by service as a paratrooper in northern Europe. Since 1946 he has been an engineer assistant in his present employment.

R. E. Selberg, a native of Portland and graduate of Portland schools, was graduated from Oregon State College in 1947. He has been employed with Mr. Kroeker's firm since that time.

*Summary of Chapter Meetings**

• *BALTIMORE*—December 19, 1951. Following dinner at the Engineer's Club of Baltimore, the Chapter held a short business meeting at which E. R. Kent was elected as member on the Chapters Conference Committee and F. M. Hewitt was elected alternate.

H. D. Glaser introduced R. R. Longwell of Westinghouse Corp., who spoke on *Electrical Servicing in the Air Conditioning Industry*. Mr. Longwell discussed motor applications and motor maintenance, stressing that Americans are not conscious enough of motor maintenance. He showed slides depicting various selective points for motors as well as an exchange plan. Servicing booklets were distributed to the membership, and a question and answer period followed. Attendance 48. Attendance ratio 0.49.

• *CENTRAL NEW YORK*—November 28, 1951. Pres. J. H. Carpenter called the meeting to order at Howard Johnson's Restaurant, DeWitt, N.Y., and members and guests introduced themselves.

The guest speaker of the evening was C. O. Mackey, professor of heat-power engineering, Cornell University, Ithaca, N.Y., who spoke on the subject, *Effective Heat*. Professor Mackey presented data accumulated from tests on various forms of convection heat transfer equipment made in the Laboratory at Cornell. He then went on to give conclusions on the data and reviewed the methods of correlating heating output information on heat transfer equipment with calculated heat loss. Attendance 54. Attendance ratio 0.35.

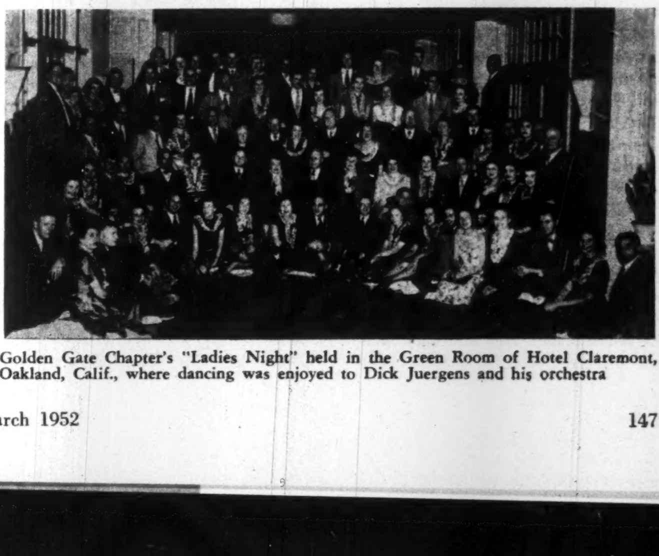
• *CINCINNATI*—January 3, 1952. The meeting was called to order by Pres. J. J. Bechtol, and members and guests introduced themselves. The minutes of the December meeting were read and approved with one correction, and F. W. Wilson presented the treasurer's report. S. O. Johnson, chairman of the membership committee, reported that 25 prospective members had been contacted. Reports were given by E. J. Kramer and Pinkney Varble for the entertainment committee, and F. J. Bottenhorn reported that the February 5 meeting would be a joint meeting with *ASRE*, with Prof. L. G. Siegel speaking on air washers, cooling towers and coils.

The guest speaker of the evening was Ernest M. Rain of the Armco Steel Corp., whose subject was *New Developments in Sheet Steels and Their Effect on the Heating and Air Conditioning Industry*. A vote of thanks was extended to the speaker and his company for their courtesy in conducting the members on a tour through the Middletown Plant. Attendance 43. Attendance ratio 0.27.

• *DELTA*—December 11, 1951. The meeting was called to order at 7:00 p.m. in the Trophy Room of the New Orleans Athletic Club. The following past presidents were introduced: J. S. Burke, Ralph Elizardi, W. H. Grant, Jr., R. B. Guest, and L. V. Busenlener. Members introduced themselves and their guests, and C. V. Bankston submitted the treasurer's report. C. B. Gamble was elected for renomination on the Society's Nominating Committee, and the five past presidents in attendance were elected to the Chapter's nominating committee with Mr. Burke acting as chairman.

The speaker of the evening was A. E. Christen, plant superintendent, Louisiana Coca-Cola Bottling Co., Ltd., who spoke on *The Coca-Cola Story and Its Relation to the Progress of New Orleans*. Mr. Christen discussed the growth of the Coca-Cola industry and its relation to the growth of the city, and then went on to discuss the process of manufacturing the drink, and to describe the plant and its mechanical equipment. Attendance 21.

• *GOLDEN GATE*—January 3, 1952. Pres. T. J. Janes called the meeting to order in the Engineers' Club, and members and guests introduced themselves. The minutes of the November and December meetings were approved as read, and T. C. Douglass, Jr., membership chairman, requested assistance in solicit-



Golden Gate Chapter's "Ladies Night" held in the Green Room of Hotel Claremont, Oakland, Calif., where dancing was enjoyed to Dick Juergens and his orchestra ing new members. Program chairman, T. J. White, announced that the February meeting would be a joint gathering with the local section of *ASRE*, and would feature a panel discussion on *Humidity Control*. An invitation to attend the Society's 58th Annual Meeting from the St. Louis Chapter was read, and J. E. Murray was appointed the representative of the Golden Gate Chapter on the Chapters Conference Committee.

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*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Following a brief intermission, a film entitled *United 6534* was shown through the courtesy of the United Air Lines.

The speaker of the evening, Ernest Felton, head of the California Weather Bureau, spoke on the subject, *Practical Application of Climatology to Agriculture and Industry*. Attendance 52.

• *INDIANA*—November 30, 1951. The meeting was called to order by Pres. F. C. Barton in the Warren Hotel, following the meeting of the board of governors.

The feature of the evening was a panel discussion on *How To Improve Air Conditioning*, with R. C. Blackman acting as moderator. The panel consisted of: R. I. Drum, W. W. Grear, F. C. Barton, all Chapter members, T. Hall, P. Phelps, and R. Ellensworth. A very interesting discussion followed, with panel members answering questions submitted from the floor. Attendance 41.

• *INLAND EMPIRE*—December 7, 1951. Pres. L. E. Marque called the meeting to order, and the minutes of the previous meeting were read and approved. It was announced that A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., and member of the Society's Chapter Relations Committee, would be the guest at the January 4 meeting and most probably would speak on *High Temperature Hot Water Heating*, and that the February meeting would feature a panel discussion. P. J. Favre and J. L. Harvey were elected member and alternate member on the Society's Chapters Conference Committee. Reports were given by the treasurer and the membership committee chairman.

G. M. Dieter introduced the speaker of the evening, Thomas Lukasik, who gave a very interesting talk on *The Flying Battleship, the B-36*. Attendance 17.

• *INLAND EMPIRE*—November 12, 1951. Pres. L. E. Marque called the meeting to order, and the minutes of the previous meeting were read and approved. J. A. Doyle submitted the treasurer's report and H. A. Bickel announced that 7 new members had joined the Chapter. P. J. Favre announced that the topic for the December meeting was *Electrostatic Precipitation*.

The speaker of the evening was Nathaniel Glickman, assistant professor of medicine and research physiologist, University of Illinois Medical School, Chicago, Ill., who spoke on *The Relationship of Man to His Physiological Environment*. Attendance 26.

• *KANSAS*—December 5, 1951. Pres. R. F. Bauer called the meeting to order in the private dining room of Wolf's Cafeteria, and the minutes of the preceding meeting were read and approved. A discussion was opened regarding the poor attendance at meetings in recent months. It was suggested that technical speakers use more illustrations and less conversation in their presentations, and R. L. Pennington announced that he could obtain the use of a film, entitled *Steel Seamless Pipe, Its Manufacture and Use*, for showing at any chapter meeting. It was also suggested that the Chapter might make an inspection trip through the new air base and other war plants to inspect the various heating, ventilating, air conditioning, and refrigerating installations.

President Bauer appointed O. P. Bullock and Charles Yoe as member and alternate member, respectively, on the Society's Chapters Conference Committee. Mr. Yoe followed with a report on the Chapter's legislative committee's progress on the new air conditioning code for the City of Wichita.

Mr. Bullock then gave a most interesting talk on the construction of a supply line to Russia. Mr. Bullock, who was in charge of the refrigeration along this line, related some very interesting experiences. Attendance 11. Attendance ratio 0.17.

• *MIAMI VALLEY*—December 5, 1951. Following dinner, Pres. C. D. Weaver called the meeting to order at 8:10 p.m. in Neil's Restaurant, and the minutes of the previous meeting were read and approved. The treasurer's report was submitted, and D. L. Bergman announced that the January meeting would have H. B. Nottage, research associate, ASHVE Research Laboratory, Cleveland, Ohio, as the guest speaker. C. D. Weaver and D. L. Bergman were elected member and alternate member on the Chapters Conference Committee.

Vice President Bergman then introduced the speaker of the evening, W. S. Harris, special research associate professor, University of Illinois, Urbana, Ill., who spoke on *Baseboard Heating*. Professor Harris' talk covered the tests conducted at the University of Illinois and sponsored by the *Institute of Boiler and Radiator Manufacturers*. He stated that these tests were run in a two-story, insulated brick home, and from the test data taken, it was evident that baseboard radiation obtained a lower room temperature gradient than had been obtained with other types of radiation. Best results were obtained by blanketing all walls with baseboard radiators. Professor Harris stated that tests were also run in a basementless house and satisfactory floor temperatures were obtained with baseboard radiators along the outside wall. Attendance 28.

• *MINNESOTA*—December 1, 1951. Pres. E. F. Snyder called the meeting to order in the Robin Hood Room of the Dyckman Hotel, and the minutes of the November meeting were read and approved. Reports were given by J. V. Borry for the membership committee, and V. E. Pearson, the treasurer. President Snyder reappointed Secretary J. A. Holbrook as civilian defense chairman for the Chapter, and William Sturm was appointed in charge of information and arrangements for the St. Louis Meeting in January.

Prof. A. B. Algren introduced the president of the Society, Dean L. E. Seeley, College of Technology, University of New Hampshire, Durham, N.H., President Seeley began his brief talk by urging members to bring their families to the Society's Annual and Semi-Annual Meetings, and thereby become acquainted with members from other parts of the country. Dean Seeley also encouraged the members to take part in Society activities. He stated that, since the heating and ventilating engineer creates environment, he performs a direct service to the public. In view of this, he urged better public relations, suggesting television as an excellent medium of presenting the nature of the heating and ventilating engineer's work to the public.

Following Dean Seeley's talk, William Sturm, program chairman, introduced the speaker of the evening, R. L. Maher, engineer with the Chase Brass & Copper Co., Waterbury, Conn., who spoke on *The General Principles and Design Practices of Radiant Panel Heating*. Attendance 114.

• *MINNESOTA*—November 1, 1951. Members and guests met in the Robin Hood Room of the Dyckman Hotel, and Pres. E. F. Snyder called the meeting to order. The minutes of the October meeting were read and approved, and new members and guests were introduced. The following were elected member and alternate member, respectively, on the Chapters Conference Committee for 1952: President Snyder and Vice Pres. William Sturm.

The speaker of the evening was J. M. Hartman, engineer with Kewanee Boiler Corp., Kewanee, Ill., who spoke on the history, ratings, performance characteristics, and the application of heating boilers. Attendance 118.

• *NORTHERN OHIO*—December 10, 1951. Pres. John Richmond called the meeting to order in the Warner Auditorium, and preceding the business meeting, Jack Cresson gave a brief talk on the activities of the Cleveland Baseball Club. Mr. Cresson gave some interesting information on the prospects for new material for the 1952 season.

The minutes of the November meeting were read and approved, and President Richmond announced that the *Cleveland Technical Society Council* banquet was scheduled for January 28 at the Hotel Carter. It was also announced that the January meeting would be a joint meeting with *ASRE*.

The speaker of the evening, L. S. Reagan, vice president and general manager of The Webster Engineering Co., Tulsa, Okla., was then introduced. Mr. Reagan spoke on *Application of Gas Burning Equipment to Heating Boilers*. He stated that the size of combustion space depends upon flame length rather than the design combustion rate, and that other factors affecting the size of the space are refractory temperature and the location of cold surfaces. Mr. Reagan indicated that a good average value for combustion chamber volume for natural gas is 35,000 Btu per cu ft, however, this value may be exceeded under certain conditions. In considering the subject of drafts, he stated that the present tendency is to use low stacks, and mentioned that due to the insufficient natural draft produced by such stacks, forced draft has been used to an increasing extent.

Mr. Reagan then went on to stress the importance of air supply to the boiler room, mentioning that he had found installations in which the boiler room was completely sealed and complaints were being received concerning insufficient air. Mr. Reagan showed slides demonstrating the effects on draft losses due to overloading a boiler and curves showing the natural draft due to stacks. Stating that the efficiency of many heating boilers averages about 75% and that high efficiency is not of a maximum importance in small heating boilers, he went on to discuss the factors affecting the selection of control valves and floor insulation. Attendance 98. Attendance ratio 0.34.

• *NORTH TEXAS*—December 19, 1951. The December meeting was in the form of the Chapter's Annual Christmas Party, which was held at the Lakewood Country Club. During a brief business session, called to order by Pres. R. G. Lyford, the election of the following officers for 1952 was announced: *president* — R. E. Allison; *vice president* — P. N. Vinther; *secretary* — M. W. Brown; *treasurer* — J. A. Ray; and *board of governors* — R. G. Lyford, W. R. Barbeck, R. A. Grimmer. Attendance 181.

• *OKLAHOMA*—December 10, 1951. The meeting was called to order by Pres. J. H. Carnahan at Beverly's Drive-In at 8:00 p.m. As there was no business to be taken care of, the speaker of the evening, F. B. Clements, manager, Sewall Paint and Varnish Co., Tulsa, Okla., was immediately introduced. Mr. Clements presented a very interesting discussion on *Paint Need Not Peel*, assisted by V. W. Miles of the Northeastern Oklahoma Chapter of the Society. Mr. Clements stated that over 50 percent of cases of paint peeling on the outside of buildings is caused by humidity from inside the building, which permeates through the walls. Mr. Clements added that the problem can be solved in three ways: (1) provide adequate ventilation for the entire building, especially in areas where equipment introduces moisture into the air, (2) provide a vapor barrier between wood siding and sheathing, and (3) provide a moisture-proof finish on the inside of the walls. Slides were used to illustrate many of the points brought out. Attendance 57. Attendance ratio 0.51.

JOURNAL SECTION

• *OREGON*—November 8, 1951. The meeting was opened by Pres. H. W. McKenzie with the introduction of the guests attending and the reading and approval of the October minutes. Reports were made by the membership and social committees and by the treasurer. K. R. Murhard reported on the progress in plans for the 1952 Air Conditioning Conference and announced the names of the members who are taking part in making the arrangements. C. W. Brissenden reported on the Oregon Technical Council dinner, to be held on November 15, honoring Glenn Stanton and Professor McMillan. President McKenzie announced the date of the Christmas meeting, mentioning that the ladies were invited to attend, and also announced that the January meeting would be a joint gathering with the Pacific Northwest Chapter.

J. D. Kroeker introduced the speaker, Nathaniel Glickman, assistant professor of medicine and research physiologist, University of Illinois Medical School, Chicago, Ill. Professor Glickman spoke on *The Relationship of Man to His Physiological Environment*, and presented data obtained from tests on a number of persons to determine optimum temperatures for individual comfort, optimum body temperatures, reactions of cardiac patients to varying degrees of temperature and activity. Slides were used to illustrate the talk. Attendance 76. Attendance ratio 0.43.

• *ROCKY MOUNTAIN*—October 3, 1951. Pres. B. H. Spurlock, Jr., called the meeting to order at 8:00 p.m. in the Albany Hotel, Denver. J. H. McCabe, the chapter's first president, presented past president pins to R. W. Petersen for 1950, and E. J. McEahern for 1949.

The speaker of the evening was W. J. Binder, manager, Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa., who spoke on *Modern Designs and Practices in Radiant Heating and Snow Melting.* Mr. Binder centered his talk around slides and a short movie showing actual installations of snow melting systems throughout the country. Attendance 75.

• *SHREVEPORT*—December 13, 1951. Members and their wives and guests enjoyed dinner at the Palmetto Country Club, which was followed by an informal program of entertainment. Immediately following dinner, however, A. H. Otto presented a past president key to S. W. Beaty. No other business was conducted and the meeting was adjourned at 10:00 p.m. Attendance 35. Attendance ratio 0.62.

• *SOUTHERN CALIFORNIA*—December 4, 1951. The meeting was called to order by Pres. M. C. Greiner at the Carolina Pines Restaurant, Los Angeles. The reading of the minutes was dispensed with and E. C. Evans extended an invitation to all the guests to join the Society and the Chapter as well. Guests of the evening were introduced, including Mr. Holland of Los Angeles City College and his engineering class.

The meeting was turned over to R. F. Pyle, who served as moderator for the *Symposium on Various Types of Heating Systems.* The speakers and their subjects were: Edward Hamilton — *steam heating;* A. Z. Levine — *hot water heating;* William Gesselbracht — *warm air heating;* and Mark Ayers — *radiant heating.* Attendance 149. Attendance ratio 0.46.

• *UTAH*—December 12, 1951. Prior to the meeting, members and guests were taken on a guided tour of the Gadsby Steam Plant of the Utah Power & Light Co. Following dinner, Vice Pres. D. R. Wilde called the meeting to order at 7:35 p.m., and the minutes of the November meeting were read and approved.

E. D. Smith introduced P. A. Blanchard and D. H. Beck of the Utah Power & Light Co., both of whom answered questions pertaining to the operation and maintenance of the Gadsby Plant. Attendance 17.

• *UTAH*—November 14, 1951. The meeting was called to order by Pres. A. R. Curtis at 7:20 p.m., and the minutes of the last meeting were read and approved. Among the guests were three members of the *American Society of Mechanical Engineers.*

E. D. Smith, program chairman, introduced the speaker of the evening, E. M. Naughton, assistant general manager of Utah Power and Light Co. Mr. Naughton began by stating that the company had a sizable heat pump and cooling tower and extended an invitation to all members to visit the plant. He went on to explain the stages in the design and construction of the Gadsby Steam Plant. Attendance 37.

• *UTAH*—October 10, 1951. Pres. A. R. Curtis called the meeting to order and welcomed the members and guests to the first meeting of the season. President Curtis announced the new committee chairmen, many of whom gave reports on committee plans. C. L. Soderberg gave a report on the Semi-Annual Meeting in Portland, mentioning that about three or four of the papers presented were on the subject of the heat pump.

President Curtis then introduced the speaker of the evening, A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., and member of the Society's Chapter Relations Committee and the Committee on Research. Mr. Hess spoke on *Air Conditioning of Growing Plants.* Mr. Hess stated that soil only provides water and certain minerals, and that eventually all seed crops would be grown in air conditioned spaces. He said that the only source of heat for plant growth was the sun, and that it was his opinion that atomic energy could not be utilized for plant growth. Attendance 19.

• *VIRGINIA*—November 21, 1951. Pres. J. F. Boyenton called the meeting to order in the auditorium of the R. F. Trant Co. building, and the minutes of the October meeting and the November board of governors meeting were read. The following committees were elected: *nominating*

—Laurence Trant, *chairman*; J. E. White, T. B. Speights, and H. E. Marquart; and *auditing*—F. R. Ervin, *chairman*; E. D. Duval and E. R. Simpson, Jr.

Mr. Kovner, instructor for the heating class of the Norfolk Division of William and Mary and Virginia Polytechnic Institute, which is sponsored by the Virginia Chapter, reported on his work with this group. He told of the interest shown by the 12 men attending the classes, but pointed out that a larger class would be more desirable. The men attending this class, he explained, are from local suppliers of heating and refrigeration equipment.

Mr. Kovner also described the modern developments in the heating and air conditioning industry, and touched on the heat pump, bringing out the fact that even with the use of package type heat pump apparatus a knowledge of engineering is required for each application. He then outlined the necessary steps for calculating a panel heating job. He also stressed the possibilities of dehumidification with chemical agents, with special attention to the economy of combining chemical drying agents for removing latent heat in combination with conventional refrigeration for removing sensible heat. The meeting adjourned at 9:45 p.m.

• *WISCONSIN*—December 10, 1951. Members and guests met in the Ambassador Hotel, Milwaukee, for a social hour and dinner. Pres. H. F. Brinen called the meeting to order and appointed J. R. Vernon as chairman of the vocational committee for education. I. J. Rossiter, chairman of the membership committee, gave his report, and J. A. Lofte, vice president and program chairman, announced that C. M. Humphreys, senior engineer, ASHVE Research Laboratory, Cleveland, Ohio, would be the speaker at the January meeting.

President Brinen then introduced the speaker of the evening, R. S. Hoar, assistant to the executive vice president, Bucyrus-Erie Co., Milwaukee, who announced that Dr. J. T. Wilson, prominent physicist of the Allen-Bradley Co., could not participate in the panel discussion because of illness. Mr. Hoar then introduced Dr. Edward Fahy, formerly of the National University of Ireland, and now assistant professor of physics at Marquette University. The panel discussion was on the subject, *Whether the Second Law of Thermodynamics Could be Broken or Not*, and it was pointed out that this law had been stated many ways by prominent scientists. Mr. Hoar suggested that the three definitions given in THE GUIDE were generally acceptable. It was pointed out that the continued cooling of a closed system cannot be accomplished solely by the utilization of the heat-energy of that system. Mr. Hoar stated that the temperature of a body is merely the measure of the average kinetic energy-of-motion of the molecules of that body. Reference was made here to the definitions of temperature and heat as given in THE GUIDE, and Mr. Hoar brought out the fact that at least two prominent physicists believed that the law could be broken, or at least is not as immutable as believed in the past.

Dr. Fahy continued the discussion, referring to the equations of Boyle's Law and Charles' Law, from which he derived the mathematical concept of the definition of temperature previously given. He stated that the definition of temperature is quite elusive, unless defined in terms of molecular activity, and pointed out that the temperature which we feel, is the result of molecules reacting on our finger tips.

Dr. Fahy went on to explain that in the pursuit of perpetual motion machines two general kinds have been attempted, the first, an engine running on a gas that would continue to run without fuel; and the second, fundamentally similar to Maxwells Daemon, whereby the molecules with higher average kinetic energy-of-motion could be separated from those having a lower average kinetic energy-of-motion, finally resulting in temperature differences which could perform useful self-sustaining work. However, due to the inability to perfect a self-operating device that would automatically separate these different molecules, Dr. Fahy concluded that it would be impossible to construct a mechanism which could continue to take heat from a body of uniform temperature and convert it to mechanical energy. Dr. Fahy substantiated his conclusion by pointing out that heat is the most disorderly form of energy, explaining order and disorder, and stating that to obtain a successful perpetual motion device, it would be necessary to disorganize the molecular activity. Attendance 63. Attendance ratio 0.29.

STUDENT BRANCHES

• *NORTH CAROLINA STATE COLLEGE*—October 23, 1951. Pres. Sydney Narvey called the meeting to order at 7:00 p.m. in Broughton Hall at the College. Following roll call, President Narvey outlined the programs planned for the coming year, which included talks to be given by Society members, Messrs. R. S. Dill and C. F. Boester and Prof. W. S. Harris.

Prof. C. A. McKeeman, Department of Mechanical Engineering, North Carolina State College, was introduced as the Student Branch advisor and head of the heating and ventilating curriculum. Professor McKeeman outlined the Society's aims and activities and revealed the benefits derived by Society membership.

A social period, during which refreshments were served, followed. Attendance 25.

• *OKLAHOMA A & M*—December 4, 1951. Members of the Student Branch were taken on an inspection tour of air conditioning installations in various buildings. The buildings visited were: WKY Television Studio, Pasteur Medical Building, the Skirvin Hotel, and the Colcord Building. H. S. Shafer, branch manager, American Blower Corp., Oklahoma City, Okla., and member of the Oklahoma Chapter, acted as guide for the entire tour. Each of the installations inspected had been designed around the very latest type of equipment for each specific application, and was of great interest to all those who made the tour.

• *PURDUE UNIVERSITY*—January 9, 1952. N. J. Kirch, chairman of the executive committee, called the meeting to order in the Mechanical Engineering Building. The minutes of the last meeting were read and approved, and a discussion on the Engineer's Open House was conducted, some progress reports being presented. Melvin Kalfus was appointed to represent the Student Branch on the Engineer's Council, the organization sponsoring the project.

The speaker of the evening was W. T. Miller, professor of heating and ventilating, Purdue University, Lafayette, Ind., who spoke on methods of determining thermal conductivities of materials and overall heat coefficients.

The date of the next meeting was tentatively set as the first full school week in February, and the possibility of holding a joint meeting with the Indiana Chapter was discussed. Attendance 13. Attendance ratio 0.72.

• *UNIVERSITY OF TORONTO*—January 7, 1952. Members of the Student Branch were the guests of the Ontario Chapter at a dinner meeting held in the Royal York Hotel. The meeting was called to order and presided over by Pres. William Philip.

The feature of the evening was a panel discussion on *Different Types of Heating*, and J. H. Ross, vice president of the Chapter, acted as moderator. The panel speakers were J. F. O'Neill, W. A. Connor, G. C. Toms, and J. L. Hemphill, all of whom are Ontario Chapter members.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 105 applications for membership, including 24 student applications, and 8 reinstatements; in addition, 20 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by March 31, 1952, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Arkansas

BINDER, J. S., Exec. Vice Pres. & Secy., Pfeifers Plumbing & Heating Co., Inc., Little Rock. REFERENCES: Morris Benkovitz, W. J. Franklin, C. H. Miller, Brooks Turner.

CLEARY, J. P., Engr., A. W. Johnson Co., Little Rock. REFERENCES: R. E. Blaylock, W. J. Franklin, Maury Hughes, Jr., E. N. Pettit, Jr.

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BAXTER, N. G., Engr., Estimator, Automatic Equipment Co., San Diego. REFERENCES: W. J. Biggar, W. H. Hermes, III, J. A. Knowles, Norman Sharpe.

GOTT, D. J., Engr., Detroit Lubricator Co., San Francisco. REFERENCES: S. G. Hurst, D. I. Murphy, R. C. Pribuss, T. J. White.

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Eusey, M. V., Jr., Br. Mgr., Minneapolis-Honeywell Regulator Co., Baltimore. References: R. T. Bollman, E. L. Crosby, W. P. Flanigan, E. R. Kent.

New York

Carnes, Albert, Chief Engr., Metropolitan Greenhouse Manufacturing Corp., Brooklyn. References: H. S. Birkett, N. A. Degen*, M. I. Jacobs*, Saul Jacobs*.

Nyman, R. A., Design Engr., Voorhees, Walker, Foley & Smith, New York. References: Stanley Dicker, Norman Goldberg, S. I. Matzkin, Gershon Meckler.

North Carolina

Reed, W. H., III, Sr. Engr., Carrier Corp., Charlotte. References: E. S. DeWitt, J. E. Hart, R. A. Stipp, M. J. Wilson.

Tennessee

Bell, C. W. A., Mech. Engr., Kaighin & Hughes, Inc., Oak Ridge. References: N. L. Cochran*, Richard Mason*, C. A. Spears, Jr., J. F. Turner.

Larkin, R. E., Engr., T. J. O'Brien Engrg. Co., Memphis. References: A. T. Bevil, G. C. Burr, T. J. O'Brien, W. E. Thorpe.

Texas

Metcalf, W. R., Constr. Engr., Texas Distributors, Inc., Dallas. References: L. H. Griffin, D. W. Harrington, C. B. Kendrick, J. B. Lowe.

Rodgers, F. A., Pres., Rodgers-Barbeck Co., Inc., Dallas. References: W. R. Barbeck, M. L. Brown, Jr., H. F. Curtis, F. J. Nunlist.

Utah

Baker, E. L., Gen. Mgr., Burbidge Coal Co., Salt Lake City. References: C. E. Ferguson, J. L. Margetts, W. L. Stuewe, D. R. Wilde.

Evans, R. C., Design Engr., Mechanical Equipment Co., Salt Lake City. References: R. C. Brown, G. C. Campbell, E. V. Gritton, R. A. Pons.

Gollaher, M. L., Chief Engr., Louis A. Roser Co., Salt Lake City. References: E. V. Gritton, D. B. Holford, E. I. Watts, D. R. Wilde.

Washington

Geiser, R. A., Designer, Bouillon & Griffith, Seattle. References: Lincoln Bouillon, H. T. Griffith, M. J. Hauan, H. M. Hendrickson.

Canada

Angus, D. L., Assoc., H. H. Angus & Assoc., Ltd., Toronto, Ont. References: H. H. Angus, J. H. Fox, William Philip, H. R. Roth.

Overend, G. B., Engr., Johnson Temperature Regulator Co. of Canada, Ltd., London, Ont. References: Frank Alton, R. A. LeVoi*, G. A. Playfair, W. L. Rootham.

Playfair, G. A., Br. Mgr., Johnson Temperature Regulation Co. of Canada, Ltd., Toronto, Ont. References: H. H. Angus, Arthur Nearingburg, M. F. Thomas, G. L. Wiggs.

PREBENSEN IN NEW POST

H. J. Prebensen has been elected president of Air Comfort Corp., Chicago, as announced by the Board of Directors.

Mr. Prebensen has been associated with the corporation as vice president and general manager since its inception in 1934. During World War II, Lt. Colonel Prebensen served as chief of Industrial Division of the Chicago Ordnance District. Prior to his association with Air Comfort Corp., he was a member of the firm of V. D. Simons, Inc., industrial consulting engineers. He is a graduate of Armour Institute of Technology, with a B.S. degree in electrical engineering and an advanced M.E. degree.

H. J. Prebensen

Mr. Prebensen joined the Society in 1938, and is a member of the

Council of *The American Society of Refrigerating Engineers.* He is a registered professional engineer in the states of Illinois and Indiana.

COLEMAN ELECTED TO PITTSBURGH EXCHANGE

James L. Coleman, Jr., associate member of ASHVE and president of Sauer, Inc., Pittsburgh, mechanical contractors, was elected to serve on the board of directors of the Pittsburgh Builders Exchange, as announced by the Exchange. Also elected to serve with Mr. Coleman is Lloyd K. Zinn, vice president of Howard P. Foley Co., electrical contractors, also of Pittsburgh. Mr. Coleman and Mr. Zinn will fill vacancies on the fifteen-man board, the thirteen other members being reelected.

IEC ELECTS NEW OFFICERS

At the Annual Meeting of the *Illinois Engineering Council* the following officers were elected for 1952: president—G. C. Laughlin, director from Chicago Section of *ASME*; first vice president—R. R. Bartelsmeyer, director from *Illinois Association of County Superintendents of Highways*, Belleville; second vice president—J. A. Harrington, director from Chicago Section of *IES*; and secretary-treasurer—M. A. Faucett, director from the Central Illinois Section of *AIEE*, Urbana.

Members of the Executive Committee are A. W. Graf, director from the Chicago Section of *IRE*; W. A. Kuechenberg, member of board of governors, Illinois Chapter of ASHVE; and W. R. Marston, director from the *Western Society of Engineers*, Chicago.

OBITUARIES

I. M. BORTMAN
Washington, D.C.

I. M. Bortman, owner, Perfect Air Conditioning Co., Washington, D. C., died in his home in Bethesda, Md., on December 6, 1951 after several months of illness.

Born on June 26, 1887 in Philadelphia, Pa., he attended Central Manual High School in Philadelphia, Pa. and Temple University also of Philadelphia, Pa., for a period of two years. He graduated from George Washington University, Washington, D.C. in 1913 with a B.S. degree in chemistry. From 1909 to 1914, Mr. Bortman was associated with the U. S. Bureau of Mines in fuel and oil chemical analyses. Mr. Bortman served with the U. S. Army from 1914-18 and upon his discharge reentered the field as a sales engineer. In 1930, he joined the Challenger Oil Burner Co., New York, N.Y., where his duties consisted in opening new branches, giving instructions to oil installation crews and servicing oil burners. Mr. Bortman joined the Perfect Burner Co., of Lynn, Mass. in 1933, serving in the same capacity. He established his own heating, ventilating, and air conditioning business in 1937.

Mr. Bortman is survived by his wife, Annabelle, his mother, three sisters and three brothers, to whom the Society offers sincere sympathy.

W. STANLEY LOTT
Walla Walla, Wash.

W. Stanley Lott and his two children, Wallace, age 10, and Rose, age 20, were killed in a tragic airplane crash, which occurred somewhere in the rugged Blue Mountain region between La Grange and Pendleton, Ore., on December 19, 1951. Mr. Lott and his son had flown to Provo, Utah, in his private plane, a Beechcraft Bonanza cabin craft to bring Rose, a student at Brigham Young University, home for the Christmas holiday. On the return trip the plane ran into the area's worst snow storm of the season. Mr. Lott was 42.

Born in Lehi, Utah, on June 10, 1909, Mr. Lott attended Lehi High School and upon graduation took courses in heating, ventilating, and refrigeration. From 1930-34 and 1936-38, Mr. Lott was employed by the M.S. Plumbing and Heating Co. of Lehi. Between 1934-36, he was associated with the U. S. Mining, Smelting and Refining Co., Bingham Canyon, Utah, as pipe foreman. In 1938, Mr. Lott formed his own company, W. Stanley Lott Plumbing and Heating Co., serving as both owner and manager, and in 1944 the company's name was changed to Lott Supply Co.

Surviving are his wife, Lela, another daughter, Stania, and Mr. Lott's parents, to whom the Officers and Council extend their sincere sympathy.

H. LEE STERRY
Syracuse, N.Y.

H. Lee Sterry, executive assistant to the president of Carrier Corp., was a victim of the tragic American Airlines crash in Elizabeth, N.J. on January 22, 1952. Mr. Sterry was 51 years old and has a wife and daughter.

Born on September 22, 1901, at Norwich, Conn., Mr. Sterry attended the New London Vocational School and graduated from Syracuse University in 1924 with an M.E. degree. He started his career with the Warner and Swasey Co., machine tool manufacturers of Cleveland, Ohio, in a sales capacity. In 1933, Mr. Sterry entered Harvard University Graduate School of Business, graduating in 1934 with an M.B.A. degree. Mr. Sterry held administrative positions with The Bullard Co. of Bridgeport, Conn., from 1935-38, and with The Elliott Co. of Jeannette, Pa., from 1942-43. In the period between 1939-42, Mr. Sterry was associated with Barrington Associates, Inc., a management consulting firm in New York City. He was with Carrier Corp. from 1943 until the time of his death.

The Officers and Council of the Society extend their deepest sympathy to Mr. Sterry's widow and daughter.

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
Headquarters: 62 Worth St., New York 13, N. Y. (Tel. WHitehall 3-0377)

JOURNAL SECTION

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Three Years: M. K. Fahnestock, P. B. Gordon, R. T. Kern, D. M. Mills.

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One Year: J. E. Haines, J. W. James, E. R. Queer, G. B. Supple, L. E. Seeley.

ADVISORY BOARD

L. E. Seeley, *Chairman;* Homer Addams, Lester T. Avery, M. F. Blankin, S. E. Dibble, S. H. Downs, E. O. Eastwood, W. L. Fleisher, H. P. Gant, F. E. Giesecke, E. Holt Gurney, L. A. Harding, H. M. Hart, C. V. Haynes, D. D. Kimball, G. L. Larson, S. R. Lewis, A. J. Offner, F. B. Rowley, A. E. Stacey, Jr., G. L. Tuve, A. C. Willard, C.-E. A. Winslow, and B. M. Woods.

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GENERAL COMMITTEES

Admission and Advancement: A. W. Edwards, *Chairman (one year);* Roswell Farnham *(two years),* W. A. Danielson *(three years).*

Publication: P. J. Marschall, *Chairman;* R. P. Cook, Linn Helander.

Guide: B. H. Jennings, *Chairman;* D. B. Anderson, W. E. Long *(one year);* W. S. Harris, F. J. Nunlist, Jr., C. D. Shields *(two (years);* P. R. Achenbach, R. E. Cherne, A. B. Newton *(three years).*

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Chapters Conference: A. J. Hess, *Chairman;* G. W. Bornquist, *Vice Chairman;* W. J. Collins, Jr., *Secretary.* Members and alternate members selected by local chapters are respectively:

Atlanta: F. A. Player—J. G. Croley
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Philadelphia: F. H. Buzzard—C. J. Forve
Pittsburgh: B. B. Reilly
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St. Louis: L. L. Hamig—C. H. Burnap
Shreveport: R. M. Hood—S. W. Beaty
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Virginia: M. I. Taylor—
Washington, D. C.: S. R. Allen—G. R. Walz
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One Year: Carl F. Boester, R. C. Cross, R. S. Dill, A. J. Hess, H. A. Lockhart.

Executive: I. W. Cotton, *Chairman;* R. S. Dill, *Vice Chairman;* Carl F. Boester, John Everetts, Jr., C. O. Mackey.

Technical Advisory Committees for 1952:

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- *Group A* — Heat Distribution Within and Behind the Panel: R. S. Dill*, *Chairman.*
- *Group B* — Heat Transfer Between the Panel and the Space: J. M. Van Nieukerken, *Chairman;* C. O. Mackey*, *Vice Chairman.*
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*Member of Committee on Research.

SPRING LAKE MEETING ANNOUNCED

The New Jersey Section of New York Chapter welcomes you to Spring Lake for the Semi-Annual Meeting 1952, June 16-18, at The Essex and Sussex.

CARRIER MAKES NEW APPOINTMENTS

Russell H. Gray, a member of ASHVE, of Carrier Corporation's Atlanta sales office, has been appointed executive assistant to the executive vice president in Syracuse, as announced by Cloud Wampler, president of Carrier Corp., Syracuse, N. Y.

Mr. Wampler also announced the appointment of John M. Bickel as manager of the Dealer Sales Division, and of Ralph Ebbert as acting director of public relations. Mr. Bickel has been assistant sales manager of the division with headquarters in New York City, and Mr. Ebbert is director of the Personnel Services Department.

The appointments of Messrs. Gray, Bickel and Ebbert will succeed the three Carrier executives, H. Lee Sterry, Carl U. Spriggs, and John F. Chester, who were killed in the tragic plane crash in Elizabeth, N.J., January 22, 1952.

John A. Gazelle and George T. Long have been named as sales managers, Dealer Sales Division, with headquarters in Chicago and Atlanta, respectively. In Atlanta, Mr. Gray is being succeeded by M. H. Darby, formerly a senior sales engineer in Carrier's office in Atlanta.

Mr. Gray joined the Carrier staff in 1933, and Mr. Bickel has been with the Corporation since 1929. In 1932 Mr. Bickel organized the first dealer sales operation of the air conditioning industry. During World War II he was chairman of the Post War Planning Committee of the Corporation.

OFFICERS OF LOCAL CHAPTERS AND STUDENT BRANCHES

(46 Chapters—11 Student Branches)

- **ATLANTA:** Organized 1937. Headquarters, Atlanta, Ga. Meets, Second Monday. PRESIDENT, F. A. Player, 2110 Peachtree Rd., N. W., Atlanta. SECRETARY, J. M. Lazenby, 2641 Merry Lane, N. E., Atlanta 6.
- **BALTIMORE:** Organized 1949. Headquarters, Baltimore, Md. Meets, Third Wednesday. PRESIDENT, W. P. Flanigan, 5508 Greenleaf Rd., Baltimore 10. SECRETARY, F. M. Hewitt, 11 E. 21st St., Baltimore 18.
- **CENTRAL NEW YORK:** Organized 1944. Headquarters, Syracuse, N. Y. PRESIDENT, J. H. Carpenter, 3515 Midland Ave., Syracuse. SECRETARY, H. K. Ormsby, 205 S. Townsend St., Syracuse 2.
- **CENTRAL OHIO:** Organized 1944. Headquarters, Columbus, Ohio. Meets, Third Monday. PRESIDENT, R. S. Curl, 590 Oak St., Columbus. SECRETARY, N. T. Hess, 63 E. Goodale St., Columbus.
- **CINCINNATI:** Organized 1932. Headquarters, Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, J. J. Bechtol, P.O. Box 1667, Cincinnati 1. SECRETARY, R. C. Beineke, 626 Broadway, Cincinnati 2.
- **CONNECTICUT:** Organized 1940. Headquarters, New Haven, Conn. Meets, Third Thursday. PRESIDENT, A. J. Lawless, 110 Whitney Ave., New Haven. SECRETARY, R. W. Sidbury, 236 Grand St., Waterbury 91.
- **DELTA:** Organized 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. PRESIDENT, Theodore Offner, 1000 S. Peters St., New Orleans. SECRETARY, H. L. Salaun, 317 Baronne St., New Orleans.
- **EMPIRE STATE CAPITAL:** Organized 1951. Headquarters, Albany, N. Y. PRESIDENT, D. A. Carofano, 1821 Highland Ave., Troy. SECRETARY, G. G. Davis, 323 State St., Schenectady.
- **GOLDEN GATE:** Organized 1937. Headquarters, San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. Janes, University of California, Dept. of Grounds & Bldgs., Berkeley 4. SECRETARY, J. E. Murray, 1095 Market St., San Francisco 3.
- **ILLINOIS:** Organized 1906. Headquarters, Chicago, Ill. Meets, Second Monday, PRESIDENT, George W. Bornquist, 605 W. Washington Blvd., Chicago 6. SECRETARY, G. V. Zintel, 1217 W. Washington Blvd., Chicago 7.
- **INDIANA:** Organized 1943. Headquarters, Indianapolis Ind. Meets, Fourth Friday. PRESIDENT, F. C. Barton, 912 K. of P. Bldg., Indianapolis. SECRETARY, R. C. Blackman, 5505 N. Illinois St., Indianapolis 8.
- **INLAND EMPIRE:** Organized 1950. Headquarters, Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, L. E. Marque, 3803 N. Atlantic, Spokane. SECRETARY, R. J. Harris, 116 N. Division St., Spokane 8.
- **IOWA:** Organized 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, C. H. McGuiness, 712 Park St., Des Moines. SECRETARY, J. F. Sandfort, M. E. Dept., Iowa State College, Ames.
- **KANSAS:** Organized 1951. Headquarters, Wichita, Kan. PRESIDENT, R. F. Bauer, 434 N. Rock Island, Wichita. SECRETARY, E. G. Fahnestock, P.O. Box 2581, Hillside Station, Wichita.
- **KANSAS CITY:** Organized 1917. Headquarters, Kansas City, Mo. Meets, First Monday. PRESIDENT, C. W. Schumacher, 1920-22 Grand Ave., Kansas City, Mo. SECRETARY, G. H. Stoffer, 200 Riss Bldg., 15 West 10th St., Kansas City 6, Mo.
- **MANITOBA:** Organized 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, J. F. Bertram, 550 Notre Dame Ave., Winnipeg. SECRETARY, A. K. Piercy, 222 Osborne St., N., Winnipeg.
- **MASSACHUSETTS:** Organized 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. PRESIDENT, John Bonner, 92 Broadway, Cambridge 42. SECRETARY, L. R. Geissenhainer, 89 Broad St., Boston 10.
- **MEMPHIS:** Organized 1944. Headquarters, Memphis, Tenn. Meets, Third Monday. PRESIDENT, R. E. Larkin, 515 W. Clover Dr., Memphis. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union, Memphis 3.
- **MIAMI VALLEY:** Organized 1950. Headquarters, Dayton, Ohio. Meets, First Wednesday. PRESIDENT, C. D. Weaver, 1136 U.B. Bldg., Dayton 2. SECRETARY, R. W. Kimmel, 947 Westminster Pl., Dayton 9.
- **MICHIGAN:** Organized 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, G. W. Akers, Box 238, R.F.D. 2, Rochester, Mich. SECRETARY, R. H. Oberschulte, 316 McKerchey Bldg., Detroit 1.
- **MINNESOTA:** Organized 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. PRESIDENT, E. F. Snyder, Jr., 4324 Zenith Ave. N, Minneapolis 22. SECRETARY, J. A. Holbrook, 65 North 17th St., Minneapolis 3.
- **MONTREAL:** Organized 1936. Headquarters, Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, J. G. Chenevert, 1440 St. Catherine St. W., Montreal. SECRETARY, B. J. Horsburgh, 637 Craig W., Rm. 212, Montreal.
- **NEBRASKA:** Organized 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. PRESIDENT, K. E. Martin, 204 Barker Bldg., Omaha 2. SECRETARY, O. J. Smith, 233 Grain Exchange Bldg., Omaha 2.
- **NEW YORK:** Organized 1911. Headquarters, New York, N. Y. Meets, Third Monday. PRESIDENT, Ernst Graber, 215 Hollywood Ave., Douglaston, L. I. SECRETARY, Carl H. Flink, 62 Worth St., New York 13.
- **NORTH CAROLINA:** Organized 1939. Headquarters, Durham, N. C. Meets, Quarterly. PRESIDENT, L. L. Vaughan, P. O. Box 5746, Raleigh. SECRETARY, C. A. McKeeman, M.E. Dept., North Carolina State College, Raleigh.
- **NORTH TEXAS:** Organized 1938. Headquarters, Dallas, Tex. Meets, Third Monday. PRESIDENT, R. E. Allison, 607-11 First Ave., Dallas 10. SECRETARY, M. W. Brown, 1213 Texas Bank Bldg., Dallas 2.
- **NORTHEASTERN OKLAHOMA:** Organized 1948. Headquarters, Tulsa, Okla. PRESIDENT, C. H. Dollmeyer, Jr., 1533 N. New Haven Ave., Tulsa 15. SECRETARY, V. W. Miles, 624 So. Boston Ave., P. O. Box 871, Tulsa.
- **NORTHERN OHIO:** Organized 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. PRESIDENT, John Richmond, 10210 Woodland Ave., Cleveland 4. SECRETARY, R. G. Huebscher, 7218 Euclid Ave., Cleveland 3.
- **OKLAHOMA:** Organized 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, J. H. Carnahan, 320 Oklahoma Natural Gas Bldg., Oklahoma City 2. SECRETARY, W. J. Collins, Jr., 224 Oklahoma Natural Gas Bldg., Oklahoma City.
- **ONTARIO:** Organized 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, William Philip, 5 Barbara Crescent, Toronto, Ont. SECRETARY, H. R. Roth, 57 Bloor St., W., Toronto, Ont.
- **OREGON:** Organized 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, H. W. McKenzie, 399 Murray Ave., Beaverton. SECRETARY, R. P. Lankow, 3408 S.E. Hawthorne Blvd., Portland 15.
- **PACIFIC NORTHWEST:** Organized 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. PRESIDENT, R. M. Stern, 5121 E. 68th, Seattle 5. SECRETARY, H. T. Orebaugh, 1330 Dearborn, Seattle.
- **PHILADELPHIA:** Organized 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, E. K. Wagner, 2240 N. Broad St., Philadelphia 32. SECRETARY, A. M. Robertson, 1200 Locust St., Philadelphia 7.
- **PITTSBURGH:** Organized 1919. Headquarters, Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, W. D. Simpson, 301 Standard Life Bldg., Pittsburgh 22. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.
- **ROCKY MOUNTAIN:** Organized 1944. Headquarters, Denver, Colo. Meets, First Wednesday. PRESIDENT, B. H. Spurlock, Jr., Dept. of M. E., University of Colorado, Boulder, Colo. SECRETARY, J. W. Braak, 1230 California St., Denver, Colo.
- **ST. LOUIS:** Organized 1918. Headquarters, St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, L. L. Hamig, 1706 Olive St., St. Louis 3. SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave., St. Louis 4.
- **SHREVEPORT:** Organized 1948. Headquarters, Shreveport, La. Meets, Third Thursday. PRESIDENT, R. M. Hood, 411 Louisiana Ave., Shreveport, La. SECRETARY, M. A. Hudson, 4609 Gilbert Dr., Shreveport.
- **SOUTH TEXAS:** Organized 1938. Headquarters, Houston, Tex. Meets, Third Friday. PRESIDENT, R. J. Salinger, 910 Bankers Mtg. Bldg., Houston 2. SECRETARY, E. G. Floeter, Jr., P.O. Box 6006, Houston 6.
- **SOUTHERN CALIFORNIA:** Organized 1930. Headquarters, Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, M. C. Greiner, 1559 Club View Dr., Los Angeles 24. SECRETARY, L. B. Davenport, 137 S. Anderson St., Los Angeles 33.
- **SOUTHWEST TEXAS:** Organized 1946. Headquarters, San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, W. E. Long, Dept. of Mechanical Engrg., University of Texas, Austin. SECRETARY, L. H. Hornor, Jr., 810 Insurance Bldg., San Antonio.
- **UTAH:** Organized 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. PRESIDENT, A. R. Curtis, 5158 Cottonwood Lane, Holladay. SECRETARY, M. L. Gollaher, 1163 Roosevelt Ave., Salt Lake City 5.
- **VIRGINIA:** Organized 1946. Headquarters, Norfolk, Va. Meets Third Wednesday, PRESIDENT, D. E. Phillips, P. O. Box 674, Newport News. SECRETARY, H. E. Marquart, 111 W. Main St., Norfolk.
- **WASHINGTON, D. C.:** Organized 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. PRESIDENT, S. R. Allen, 942 Washington Bldg., Washington 5. SECRETARY, P. H. Loughran, Jr., 4513 49th St., N.W., Washington 16.
- **WESTERN MICHIGAN:** Organized 1931. Headquarters, Grand Rapids, Mich. Meets Second Monday. PRESIDENT, W. C. DeRoo, 500 E. 8th St., Holland, Mich. SECRETARY, P. D. Winchester, 322 Columbia Ave., Holland, Mich.
- **WESTERN NEW YORK:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, T. F. Killeen, 374 Delaware Ave., Buffalo 2. SECRETARY, R. E. Lang, 140 Meadow Lane, Kenmore 23.
- **WISCONSIN:** Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, H. F. Brinen, 226 Kenzie Ave., Racine. SECRETARY, L. C. Plaehn, 914 N. Broadway, Milwaukee.

Student Branches

- **COLLEGE OF CITY OF NEW YORK:** Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Seymour Weinberg, 2147 72nd Street, Brooklyn 4. SECRETARY, Benjamin Karp, 524 Berriman St., Brooklyn 8.
- **LOUISIANA POLYTECHNIC INSTITUTE:** Organized 1949. Headquarters, Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station, Ruston. SECRETARY, R. L. Gorton, Box 184, Tech Station, Ruston.
- **NORTH CAROLINA STATE COLLEGE:** Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station, Raleigh. SECRETARY, E. A. Travis, Jr., P.O. Box 3333, Bagwell Dormitory, Raleigh.
- **OKLAHOMA A. & M. COLLEGE:** Organized 1950. Headquarters, Stillwater, Okla. PRESIDENT, O. A. Brynie, 507 Midi, Vet Village, Stillwater. SECRETARY, D. W. Ray, W361 Bennett Hall, Stillwater.
- **OREGON STATE COLLEGE:** Organized 1949. Headquarters, Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. J. Kemper, Jr., 645 N. 4th, Corvallis. SECRETARY, J. M. Templer, 720 Kings Rd., Corvallis.
- **PURDUE UNIVERSITY:** Organized 1948. Headquarters, W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St., W. Lafayette.
- **TEXAS A. & M. COLLEGE:** Organized 1946. Headquarters, College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054, College Station, Tex. SECRETARY, W. C. Haggard, Box 5227, College Station.
- **UNIVERSITY OF DETROIT:** Organized 1949. Headquarters, Detroit, Mich. Meets, First Tuesday. PRESIDENT, G. H. Williams, 18251 Washburn, Detroit 21. SECRETARY, R. H. Drake, 5598 Hurlbut, Detroit 13.
- **UNIVERSITY OF KANSAS:** Organized 1949. Headquarters, Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.
- **UNIVERSITY OF TEXAS:** Organized 1949. Headquarters, Austin, Tex. Meets. First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts., Austin. SECRETARY, V. H. Miles, PHP Dorm J, Austin.
- **UNIVERSITY OF TORONTO:** Organized 1951. Headquarters, Toronto, Ont. CHAIRMAN, J. A. Slemin, 21 Wilberton Rd., Toronto, Ont. SECRETARY, T. O. Smith, 455 Avenue Rd., Toronto, Ont.

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Nineteen big FITZGIBBONS boilers bring solid comfort to the tenants, and fuel-saving economy to the owners of this fine new development, housing 2600 families. The boilers are the famous "D" Type, selected for large numbers of similar projects and developments on the basis of super-quality performance. Men who know boilers select Fitzgibbons.

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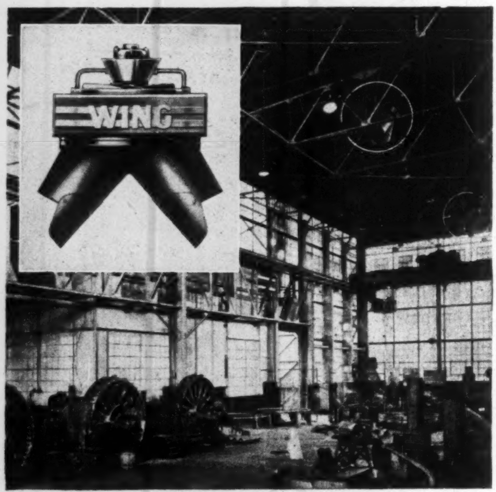
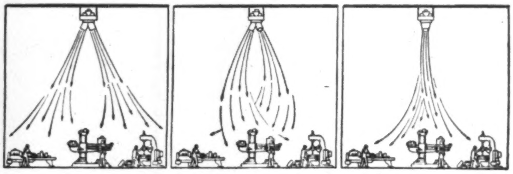
He said it was the first time in 15 years his feet had been warm!

IT happened in a large manufacturing plant in Pittsburgh where, originally, several conventional type unit heaters had been installed to heat a machine shop 300' long by 70' wide by 15' high. After many uncomfortable winters and many complaints additional units were installed. But complaints by workers continued, and finally led to an investigation of Wing Revolving Unit Heaters. First, the Wing engineer showed conclusively by smoke bomb demonstration that the warm air from the heaters in the plant did not reach the working level. Convinced of the soundness of the revolving discharge principle, the old heaters were removed and Wing Revolving Unit Heaters installed. A smoke bomb test showed how the warm air not only reached the floor, but gave complete coverage, circulating in, around and under heavy machinery and work in progress. The effect was remarkable. In fact, one old mechanic said it was the first time in 15 years his feet and legs had been warm!





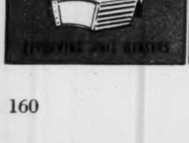
Illustrated above are (left) a plant similar in type to the one mentioned in the story, showing Wing Revolving Heaters with discharge outlets for high ceilings. Other discharge outlets are available for medium heights and low buildings and rooms. The diagram (above right) shows how the constantly turning discharge outlets thoroughly and uniformly distribute the heated air, without hot blasts or cold drafts. Workmen feel only a sensation of fresh, live, invigorating warmth. Write for a copy of Bulletin HR-6.

Wing

REVOLVING UNIT HEATERS

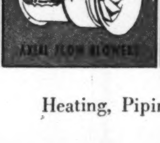
L. J. Wing Mfg. Co. 140 Vreeland Mills Rd., Linden, N.J.

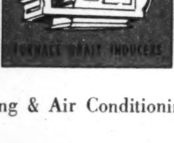
Factories: Linden, N. J. and Montreal, Canada
In Europe: Etablissements WANSON, Haren-Nord, Brussels, Belgium

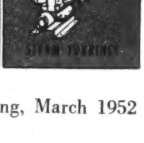


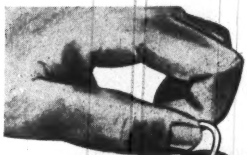
STRAIGHT LINE DUCT FANS

ELBOW TYPE DUCT FANS









PLUG *expensive water waste...*

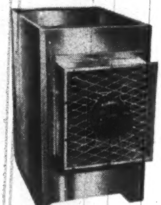
with MARLEY AQUATOWERS

Saving 90 percent of the cooling water used for air-conditioning and refrigeration installations is the function of Aquatowers. That's the saving they are delivering every day of the cooling season for more than 7,000 owners . . . and at minimum cost for installation and operation.

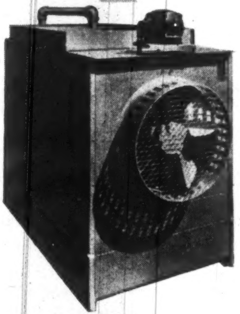
Aquatowers do their job so efficiently that they often repay their initial cost in one season. With 17 sizes available, there is an Aquatower to fit precisely every installation of 2-ton capacity or larger without excess first cost or unnecessary power requirement.

Aquatowers are engineered for utmost simplicity of installation and operation. They are shipped completely assembled, ready for operation after water and power connections are made. No expert attention is necessary to keep them functioning at top efficiency year after year.

Double-Flow Aquatowers are prefabricated for on-the-job erection.



Models 23 and 33
Up to 6 Tons
Capacity



Models 53 to 503
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New Double-Flow Aquatower
Over 50 Tons Capacity
7 SIZES AVAILABLE

ALL STEEL
or WOOD with
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DOUBLE FLOW AQUATOWERS

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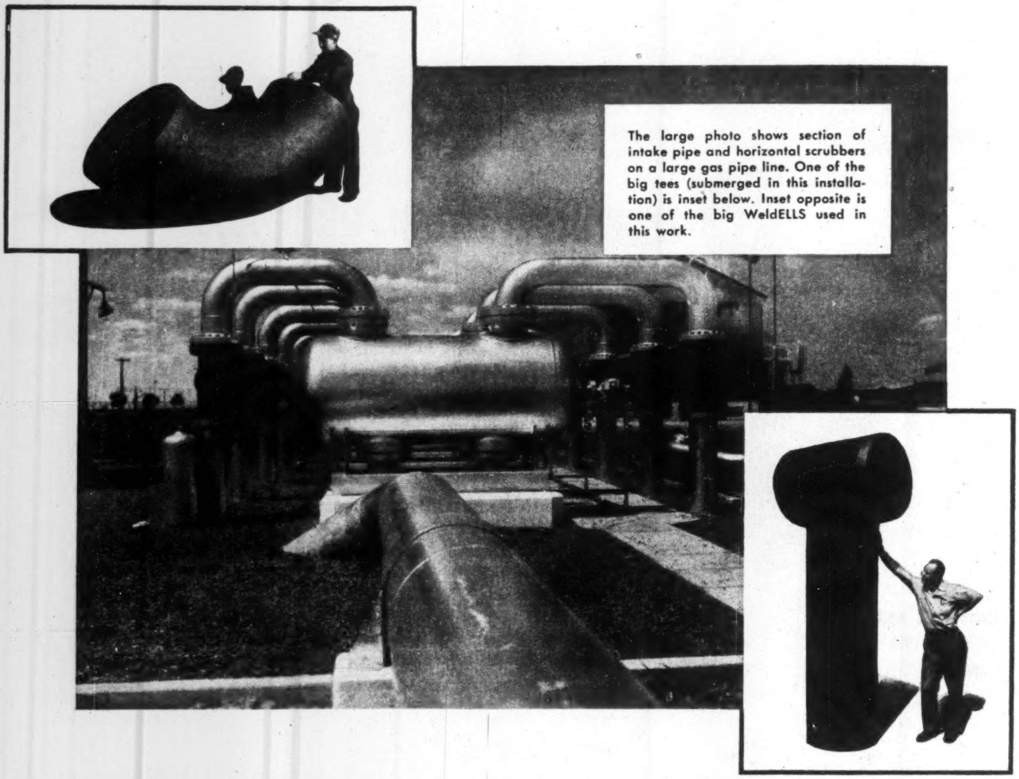
MARLEY



The large photo shows section of intake pipe and horizontal scrubbers on a large gas pipe line. One of the big tees (submerged in this installation) is inset below. Inset opposite is one of the big WeldELLS used in this work.

GUESS-WORK WON'T GO ON THE PIPE LINES

As the demand for oil and gas mounted, the pipe lines grew. The first growth was in number and miles; then in size and pressure. The use of larger pipe lines under higher pressure has hurled a challenge at the pipe designer. To hold down costs he must press further toward the yield point of pipe line materials . . . but never too near the danger point. Sound engineering is indeed required to insure safe operation under loadings that stress materials at 65% to 85% of their yield strength. There is no "margin for ignorance" here. You must *know!*

Recent Taylor Forge contributions to the pipe lines include improved designs of WeldELLS in large sizes and tees giving greater safety at branch connections . . . produced in materials whose strength matches or exceeds that of the tough API5LX pipe now being used in transmission lines.

Ask for the facts about the WeldELL line of welding fittings and Taylor Forged Steel Flanges.

TAYLOR FORGE

TF WeldELLS®

TAYLOR FORGE & PIPE WORKS General Offices and Works: P. O. Box 485, Chicago 90, Ill. Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada.

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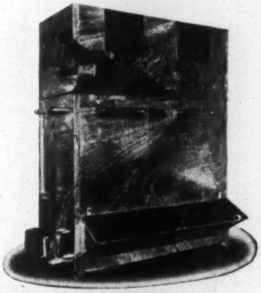
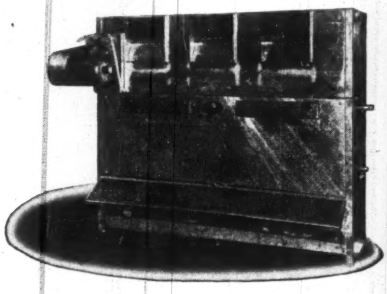
ACME Products have been manufactured continuously for more than 30 years. ACME Products are universally accepted and noted for their dependability and fine workmanship. ACME published ratings are accurate and conservative. ACME'S 30 years of engineering experience gives you economy, long life and increased efficiency on which you can build a greater volume of business and increased profits.

EVAPORATIVE CONDENSERS AND HEAVY DUTY COOLING TOWERS

1. Heavier, extra strong construction for durability. **2.** Complete moisture elimination for dry fan operation. **3.** Save more than 90% of the water required. **4.** Built in 3 sections for easy shipment and installation. **5.** Flexible fan arrangement. **6.** Hot-dip galvanized *after* fabrication. **7.** Internally mounted receivers for added storage capacity. **8.** Provision for Micromet threshold water treatment. ALL the above features, with the exception of "internally mounted receivers" and "Micromet threshold water treatment" are also available in ACME Heavy Duty Cooling Towers.





BLO-COLD* INDUSTRIAL UNIT COOLERS

1. Units available for Dry Coil or Brine Spray Operation. **2.** Available for flooded, direct expansion or brine operation. **3.** Coils may be either prime surface or finned; tubes of copper or steel pipes. Fins aluminum or steel. Coils, steel pipes and fins may be hot-dip galvanized. **4.** Vertical or horizontal discharge, easy accessibility to coils. **5.** Economical to operate. **6.** Air inlet front or back.

MODEL J COOLING TOWERS

1. Versatile — Model for all purposes. **2.** With or without pump. **3.** An ideal Jobber item, stock model can be used to meet all requirements.

ACME ALSO MANUFACTURES: Ammonia Condensers ● Freon Condensers ● Shell and Coil and Shell and Tube Condensers ● Dry-Ex* Water Coolers ● Hi-Peak* Water Coolers ● Fin Coils ● Pipe Coils ● Oil Separators ● Liquid Receivers ● Heat Exchangers ● Flow-Cold* Liquid Chillers ● Convectors

* Trade Mark

ACME PRODUCTS

ACME INDUSTRIES, INCORPORATED
JACKSON, MICHIGAN
CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919

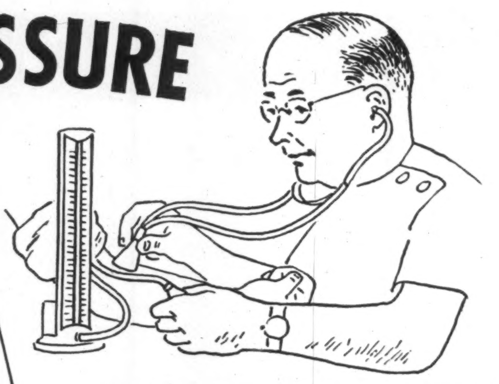
FOR HIGH PRESSURE PROBLEMS...

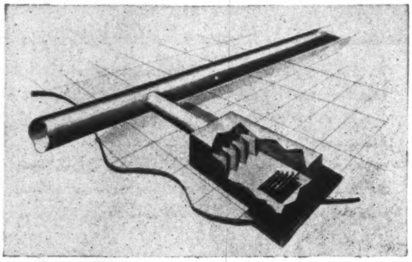
℞ CONSULT YOUR

Uni-flo®

DOCTOR...

BARBER COLMAN

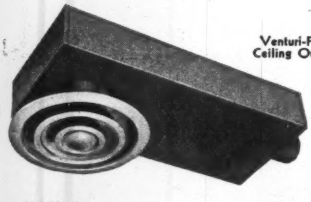




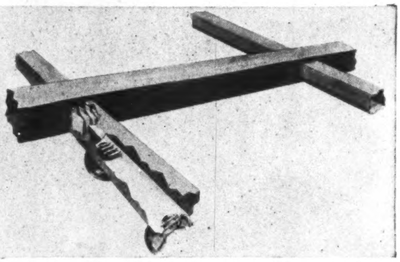
Application of Uni-Flo square outlet to high velocity system. Cutaway view of sound trap reveals a *Deflectrol,* velocity-to-static converter, and a pressure-reducing valve.

For your high velocity installation ask for the specialized services of Uni-Flo factory engineers and their extensive laboratory facilities. Barber-Colman Company has developed devices, for reduction of velocity and pressure, which can be used on systems under static pressures of any practical magnitude.

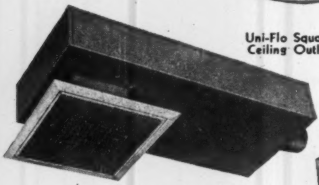
See your Barber-Colman Company local representative. He will submit your particular high pressure problems to Barber-Colman factory engineers for specific recommendations.



Venturi-Flo* Ceiling Outlet

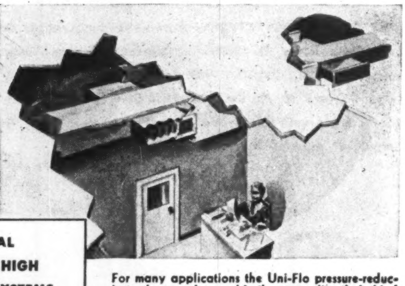


High velocity system using Barber-Colman Venturi-Flo outlets. A pressure-reducing valve is used to supply air to branch ducts at conventional velocities and pressures from a high pressure main duct.



Uni-Flo Square Ceiling Outlet

Uni-Flo Sidewall Grille



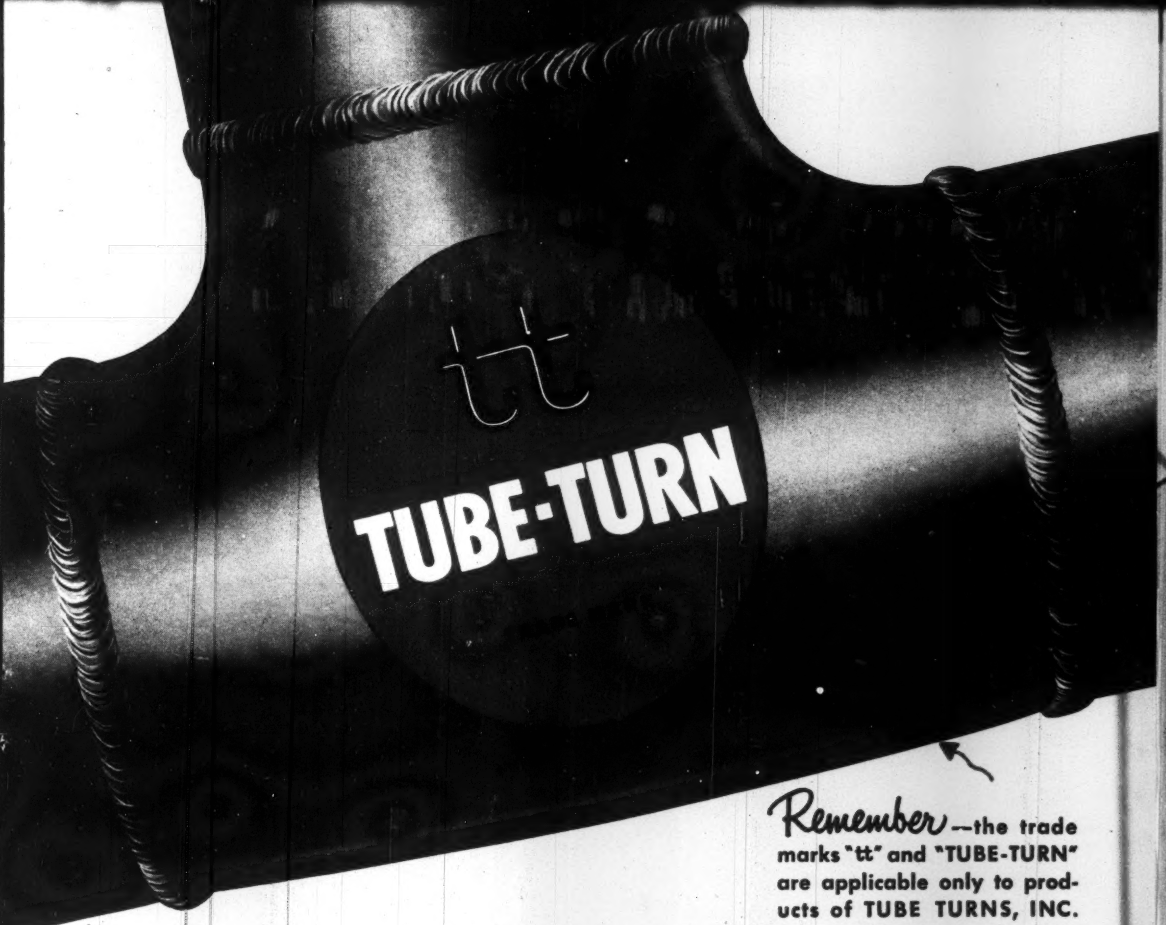
Write for new illustrated high pressure Bulletin F-4960.

* Reg. U. S. Pat. Off.

TYPICAL UNI-FLO HIGH PRESSURE SYSTEMS

For many applications the Uni-Flo pressure-reducing valve may be used in the space directly behind a Barber-Colman Uni-Flo grille.

BARBER-COLMAN COMPANY • 1228 Rock Street, Rockford, Illinois



Remember—the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Engineered to cut maintenance manhours

Scrappy says, "Aid defense—more scrap today... more steel tomorrow."

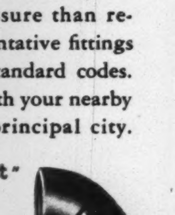
Write Dept. A-3 for free booklet on Allowable Working Pressures. Use coupon on reverse side.

CONSIDER THIS when you specify welding fittings for permanent, leakproof piping . . . the kind that's maintenance-free:

TUBE-TURN Welding Tees are drawn from seamless tubing to a barrel shape—the form every tee wants to assume under pressure. This feature, and the generous crotch radius and thickness, explain why TUBE-TURN Welding Tees withstand more pressure than required. Bursting pressures obtained in tests of representative fittings have averaged over 25% higher than required by standard codes.

For this extra quality at no extra cost get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Be sure you see the double "tt"



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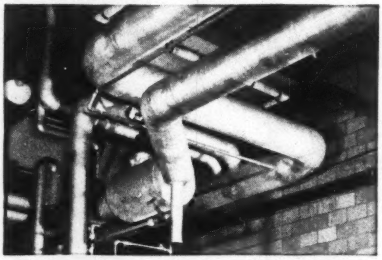
Servel, Inc. specifies piping permanence with TUBE-TURN Welding Fittings

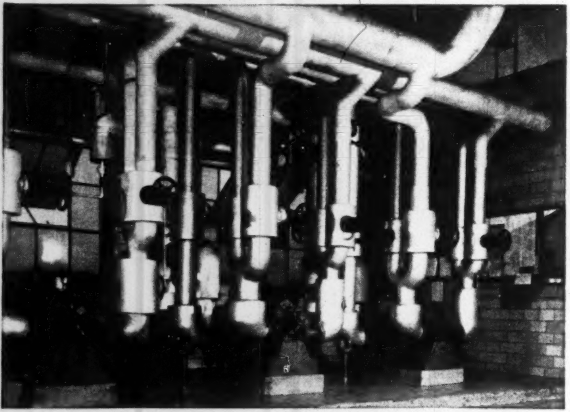
THE EXTENSIVE piping systems which serve the modern 70-acre Servel plant, in Evansville, Indiana, carry steam, condensate, air, water, acetylene, ammonia, hydrogen, oxygen, and natural gas—*efficiently.*

To avoid leakage and downtime for piping repairs, Servel engineers specify the use of TUBE-TURN Welding Fittings and Flanges for all lines 2 inches and up. Thus maintenance expense is cut to the bone. The welded system also conserves space, and provides optimum flow conditions.

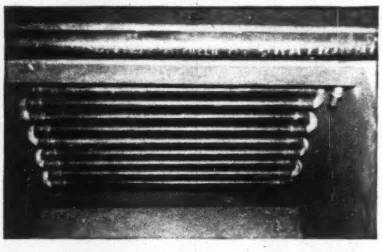
Such efficiency in production services has played a large part in the growth of Servel, Inc., makers of the famous Servel gas and electric refrigerators and a variety of other products.



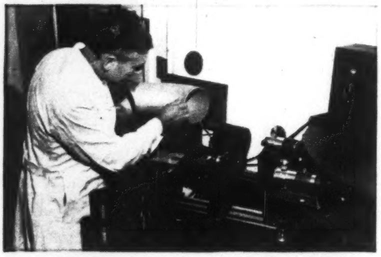
With no flanges to work around, insulation was easily applied to welded steam lines. Joints will not leak, and insulation will last.



These 2½", 3", 6", and 8" lines for return water pumps and water booster pumps are fabricated with TUBE-TURN Welding Fittings. Close-fitting welded piping is compact and neat.



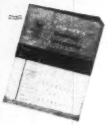
Steel blanks for cartridge cases are washed in this tank prior to forging operation. Time was saved in tank construction by fabricating heating coils with 1½" TUBE-TURN Welding Returns. Dimensional accuracy assured perfect line-up.



Careful quality control is demonstrated by this spectrographic analysis, made of every TUBE-TURN alloy Welding Fitting before pickling, passivating, and shipping. This check, one of many, assures that user's specifications are met.

Want Pressure Data?

Tube Turns, Inc. has prepared a booklet of pressure tables covering TUBE-TURN Welding Fittings in all sizes, weights, and regularly manufactured materials for Power, Oil, Heating, Gas, and Refrigeration Piping. [illegible]



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Nature of Business ....
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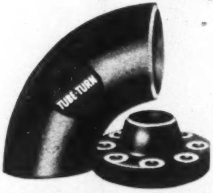

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Costs LESS to Buy and Install

Here's a new ceiling air diffuser that is fully adjustable, yet maintains a constant diffusion pattern. It offers

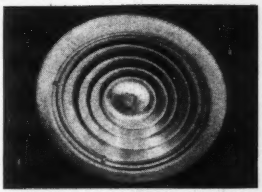
TWO BIG FEATURES

1. Only the Flexiflo has infinitely variable effective area so that air delivery can be varied from near zero to full output without changing the characteristic air pattern. Adjustability is achieved by turning the center knob. This makes it quick, easy and simple to balance the system. Air continues to flow in a stream parallel to the ceiling.

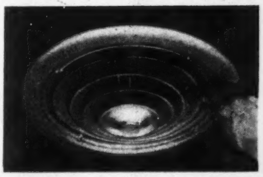
2. Exclusive built-in, self-contained equalizing deflectors that are easily adjustable, after being installed.

These special Flexiflo features are built into a quality diffuser—at a mighty attractive price.

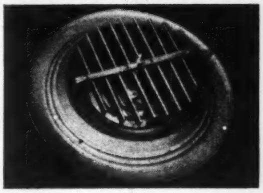
Write for the Flexiflo Engineering Manual and Prices.



Showing the Flexiflo in closed position.



The blades of the equalizing deflector are adjusted after the diffuser has been installed; no special tools required — just a screwdriver.



Rear view of Flexiflo, showing equalizing deflector attached directly to main crossbar. Blades are individually movable and remain fixed in any position to direct and equalize air flow. They can also be used to restrict the volume where a large reduction in neck velocity becomes necessary after installation.

The unique, high aspirating action of the Flexiflo eliminates objectionable drafts, and prevents air stratification, thereby rapidly equalizing the temperature.

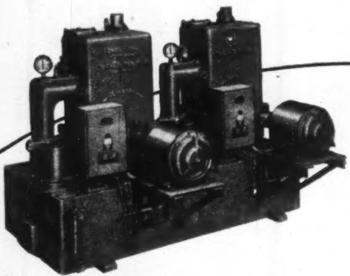
FLEXIFLO

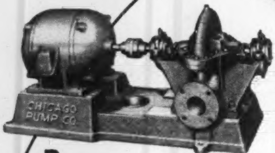
UNIVERSAL DIFFUSER CORP.

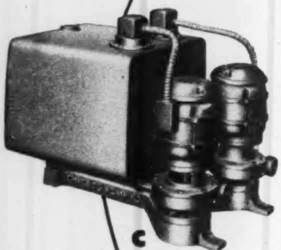
892 WHITTIER STREET • NEW YORK 59, N. Y.

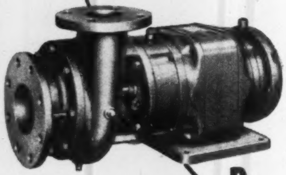
A. CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP—No vacuum on stuffing boxes, ample clearance in rotating members. It costs less to operate a Condo-Vac. Bulletin 270.

B. TYPE "D" DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP—For House Pumps—Fire and Booster service. A ruggedly built pump for long trouble-free service. Capacities up to 1,900 G.P.M.—Heads up to 530 ft. Bulletin 101.









3 REASONS
Why Engineers Specify
CHICAGO PUMPS

These are three sound reasons why more and more Engineers specify Chicago Pumps:

1 The Chicago Line is complete. There is a Chicago Pump for every service within the building. There's no division of responsibility—you can satisfy all your pump requirements through one central source.

2 Chicago Pumps embody the most advanced engineering developments. The know-how of over 40 years' specialized pump manufacturing experience goes into every Chicago Pump.

3 Chicago Pumps are constructed right. Their reputation for trouble-free, dependable performance has been justly won.

Many Engineers have adopted a Time and Dollar Saving Policy by Specifying CHICAGO — the Pumps for every building need.

CHICAGO PUMP CO.
E

CHICAGO
INDUSTRIAL
PUMPS

C. SURE RETURN CONDENSATION PUMP AND RECEIVER—Designed specifically to return HOT water to the boiler. It will not steam bind. Pump suction is always under head and suction opening is unusually large. Capacities up to 35,000 EDR and up to 50 psi. Bulletin 250.

D. TYPE "N" CLOSE COUPLED BOOSTER PUMP—Designed to handle the toughest pumping jobs efficiently and in the least possible space. Precision mechanical seal insures against leaking. Capacities up to 500 G.P.M.—Heads to 215 ft.

E. FLUSH-KLEEN SEWAGE EJECTOR—The only absolutely clog-proof ejector. Impellers handle nothing but strained sewage minimizing wear. Bulletin 122.

CHICAGO PUMP COMPANY
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY — CHICAGO 14, ILLINOIS

Condo-Vac, Sure Return. AVC, LVC,
Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems.

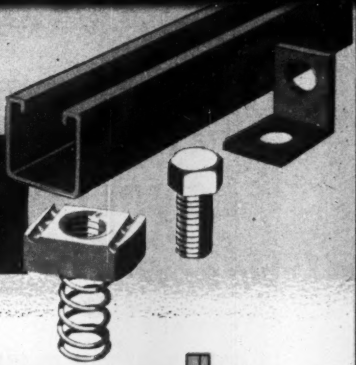
Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

typical UNISTRUT® framing applications

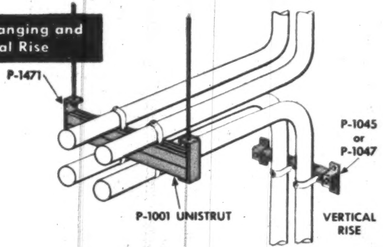
TO SUPPORT, SUSPEND AND MOUNT ALL KINDS OF MECHANICAL PIPING

No drilling, no welding, no special tools or equipment— adjustable UNISTRUT framing assures exact slope or pitch!

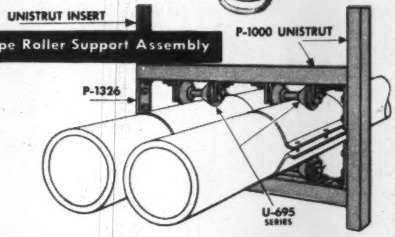
The UNISTRUT method conserves steel, reduces manpower hours, cuts overall costs.



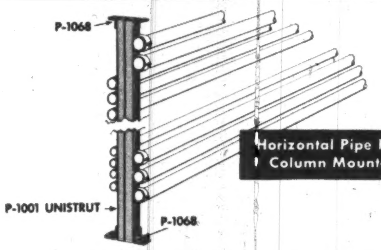
Trapeze Hanging and Vertical Rise


P-1471
P-1045 or P-1047
P-1001 UNISTRUT
VERTICAL RISE

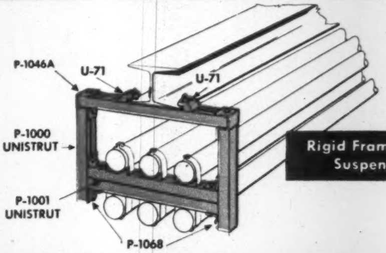
Pipe Roller Support Assembly


UNISTRUT INSERT
P-1000 UNISTRUT
P-1326
U-695 SERIES

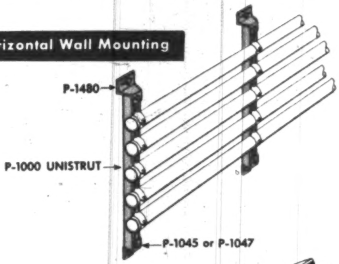
Horizontal Pipe Run, Column Mounted


P-1068
P-1001 UNISTRUT
P-1068

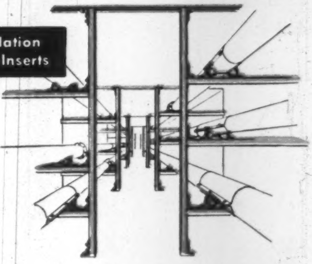
Rigid Frame Beam Suspension


P-1046A
U-71
U-71
P-1000 UNISTRUT
P-1001 UNISTRUT
P-1068

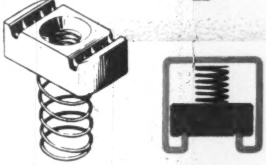
Horizontal Wall Mounting


P-1480
P-1000 UNISTRUT
P-1045 or P-1047

Tunnel Installation with Concrete Inserts



***Only* UNISTRUT** offers this Spring-Held Clamping Nut which ties together both sides of the slotted channel and forms a *Box Section* at points of connection for greater load strength.



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of New 78-page Catalog No. 7001 includes above drawings and countless other examples of how to mount, rack, frame, suspend and support all kinds of mechanical and electrical equipment.

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U. S. Patent Numbers
2327587 2329815
2345650 2363382
2380379 2405631
2541908
Other Patents Pending

For Defense Production—Every day the value of UNISTRUT products is being proved by their use in Defense Industries and Armed Services installations where flexibility, and assembly and erection speed count most.

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The World's Most Flexible All-Purpose Metal Framing

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Please send without obligation the items checked below:

☐ Catalog No. 700 ☐ UNISTRUT Sample

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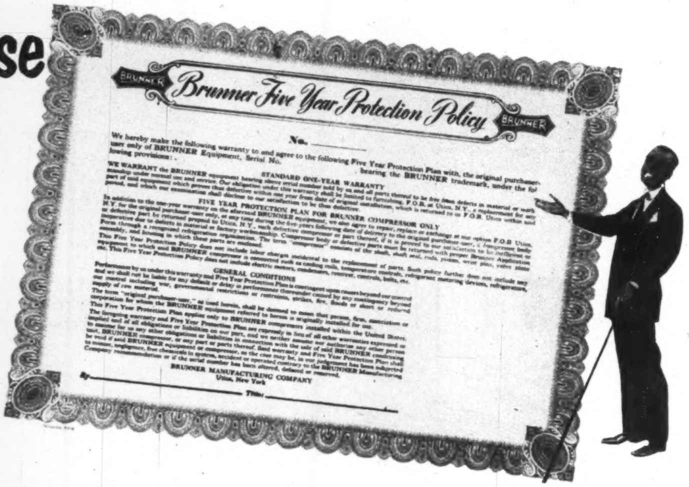
You'll like these EXCLUSIVE SELLING ADVANTAGES!



Brunner Five Year Protection Policy

No. __________

STANDARD ONE-YEAR WARRANTY

FIVE YEAR PROTECTION PLAN FOR BRUNNER COMPRESSOR ONLY

GENERAL CONDITIONS

BRUNNER MANUFACTURING COMPANY
Utica, New York

By __________ Title: __________

Look what Brunner has to offer...

A FIVE YEAR PROTECTION POLICY

Only Brunner Dealers, at their option, can offer this 5 Year Protection Policy on the Brunner "open type" compressors installed in all four models of Brunner Air Conditioners. This exclusive and absolute protection available to your customers removes every question as to "what's the best buy in air conditioning".

3 STYLES...4 SIZES

BAC Style "S"—Cooling section, blower section and plenum, front discharge and air return grilles.

BAC Style "D"—Cooling section, blower section with top duct connection, front air return grille.

BAC Style "R"—Cooling section, front air return grille. No fan section.

Hundreds of satisfied customers will vouch for the dependable operation of Brunner air conditioners in all sections of the country. The large number of units sold and the service satisfaction given their buyers is ample evidence that BRUNNER is a line with unusual customer acceptance. When you are known as the Brunner Dealer customers will be *asking you* about Brunner Air Conditioners.

DIRECT MAIL LITERATURE! Selling Aides to Help You Tell Your Customers—QUICK!

In addition to a forceful advertising program in leading magazines read in your area, Brunner offers their dealers sales-clinching literature for direct mailing. If you are in business to make money, *write the factory today and ask for the 1952 Brunner Air Conditioner Selling Program.*

BRUNNER
SINCE 1906

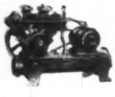
AIR CONDITIONERS

Self Contained Models in 4 Sizes and in 3 Styles...3, 5, 7½, 10 hp. Capacities.

BRUNNER MANUFACTURING CO., UTICA 1, NEW YORK, U. S. A.

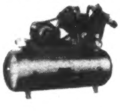
BRUNNER
SINCE 1906

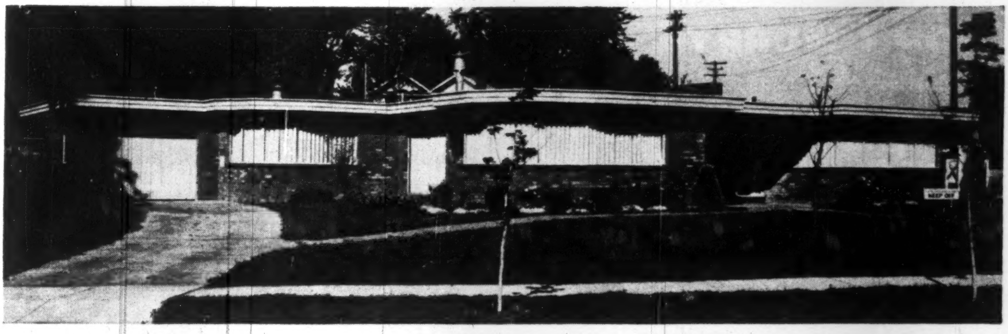
REFRIGERATION
Condensing Units from ¼ hp. to 75 hp. 69 Air and Water Cooled Models.



AIR CONDITIONING
Self Contained Units to 10 hp. Condensing Units for Remote Installation to 75 hp.

AIR COMPRESSORS
Single stage ¼ hp. to 2 hp. Two stage 1½ hp. to 15 hp. Horizontal and Vertical Models.





A mile of pipe for a mile-high house!

• "Sun-Age Homes"* are well-known in mile-high Denver. Windows are big (over 40% of wall area). Plenty of storage space is built-in. The functional design makes for easy living. And—

Radiant heating is an important selling feature of every Sun-Age Home. Not just the interior, but the driveway and sidewalks of the house are heated with 6000 feet of NATIONAL *Steel* Pipe—the standard pipe for hot-water heating for over 60 years.

In the first 10 days that this sample home was displayed, over 8,000 adults visited it. *90%* of these people requested more information on radiant heating and snow melting. This intense public interest in the comfort and convenience of these systems has helped to sell a lot of Sun-Age Homes—just as it's helping to sell homes in every part of the country.

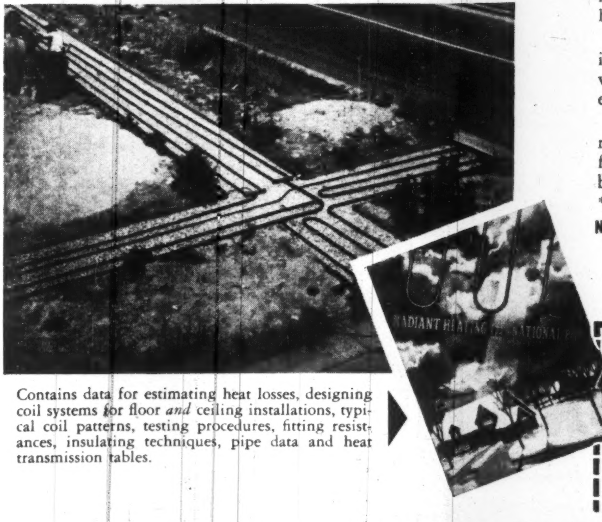
NATIONAL *Steel* Pipe is just the thing for an installation like this: It's economical. It's easy to weld. It's strong. Yet it's ductile enough to allow easy bending.

NATIONAL *Steel* Pipe has been widely used for radiant heating, so get the full particulars. This information is yours for the asking in our 48-page book, "Radiant Heating." Send the coupon now.

Trade Mark, Reg.

NATIONAL TUBE DIVISION, UNITED STATES STEEL COMPANY
PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Contains data for estimating heat losses, designing coil systems for floor *and* ceiling installations, typical coil patterns, testing procedures, fitting resistances, insulating techniques, pipe data and heat transmission tables.

NATIONAL TUBE DIVISION
United States Steel Company
525 William Penn Place, Pittsburgh 30, Pa.

Please send your free Bulletin No. 19, "Radiant Heating."

Name ....
Company ....
Address ....
City & State ....

U·S·S NATIONAL Steel PIPE

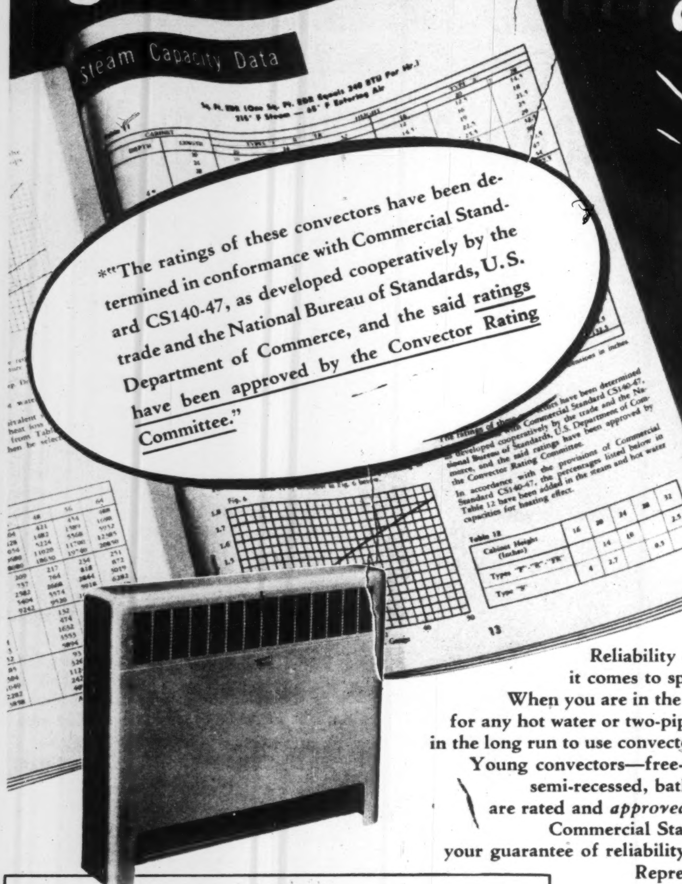
USS

UNITED STATES STEEL

DON'T WORRY!...USE

Young Convectors

WITH PUBLISHED APPROVED* RATINGS



Steam Capacity Data
?
?

*"The ratings of these convectors have been determined in conformance with Commercial Standard CS140-47, as developed cooperatively by the trade and the National Bureau of Standards, U.S. Department of Commerce, and the said ratings have been approved by the Convector Rating Committee."

Reliability of ratings is a real boon when it comes to specifying any heating equipment. When you are in the market for convectors—for any hot water or two-pipe steam system—you'll find it pays in the long run to use convectors with *approved ratings.* Young convectors—free-standing, wall-hung, semi-recessed, bathroom, and low-level models—are rated and *approved* in conformance with Commercial Standard CS140-47—your guarantee of reliability. See your nearest Young Representative or write for full details.

1927 • 1952
25 YEARS OF PROGRESS IN HEAT TRANSFER ENGINEERING

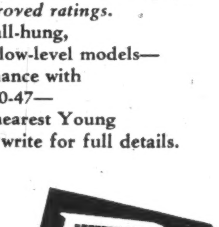
YOUNG

Heating, Cooling, Air Conditioning Products for Home and Industry.

Heat Transfer Products for Automotive and Industrial Applications.

YOUNG RADIATOR COMPANY
Dept. 512-C • RACINE, WISCONSIN
Factories at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Offices in all Principal Cities

If you think all convectors are alike, you'll find Catalogs No. 4049 and 4150 revealing. They give full details, including illustrated features of Young Convectors, approved ratings, dimension data, etc. Be sure to have a copy in your catalog file. It will be sent you without obligation.



are you using more copper

THAN IS REQUIRED?

Can you use tubing of a lighter wall, for instance, than you are now using, without losing any efficiency, and still be within standard?

Or if you contemplate a replacement, would a tube of smaller diameter serve the need as well? Would a shorter length suffice?

If, by changing the installation or slightly redesigning the unit, could you effect a saving of tube and still keep the unit at maximum operating efficiency?

Copper, as you know, is in short supply and we must conserve its use wherever possible. If in the case of copper or copper base alloy tubing you can figure out how you can use just a little less than you might normally employ, you will do your part in helping the defense program. If all of us would share in conserving this scarce metal, we could reduce our individual handicap and be able to carry on with very little loss of efficiency.

You can recognize the benefit this cooperative program can bring you.

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of seamless, nonferrous tubing
1419 CENTRAL AVENUE DETROIT 9, MICHIGAN

Wolverine Mill Depots:
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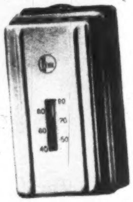
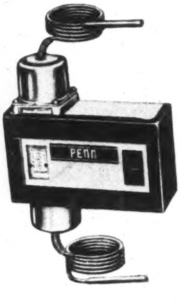
SALES OFFICES IN PRINCIPAL CITIES

Penn Series 270 temperature and pressure controls incorporate 2-pole construction and a direct-reading calibrated scale which shows both cut-in and cut-out points.

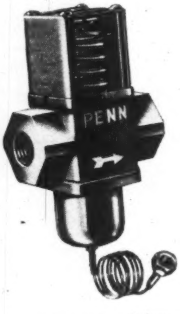


Penn Unit Heater Thermostat features "heat anticipation" and a built-in "on-off" switch. Cooling Thermostats and Humidistats are also available in the Penn line.



Series 275 Oil Protection Control with built-in Time Delay Switch for protection of all pressure-lubricated refrigeration compressors.

Penn Series 221 Solenoid Valves are direct acting and may be used with all non-corrosive refrigerants as well as for water, oil or air.



Series 246 Water Valves are built in threaded and flanged styles for all refrigerants and in sizes from ⅜" to 2½".

Penn Magnetic Starters are built in NEMA sizes 0, 1 and 1½ and are available as open-type models for control panels or with General Purpose enclosures.

THE BEST TEST . . .

REPEAT ORDER

Once you try PENN controls, you'll use them on every air conditioning, refrigeration and space heating application. Contractors and users have learned that *performance on the job* is the strongest recommendation for PENN automatic controls.

And this outstanding performance . . . this dependability and long-life accuracy result in greater customer satisfaction, more sales, more net profits.

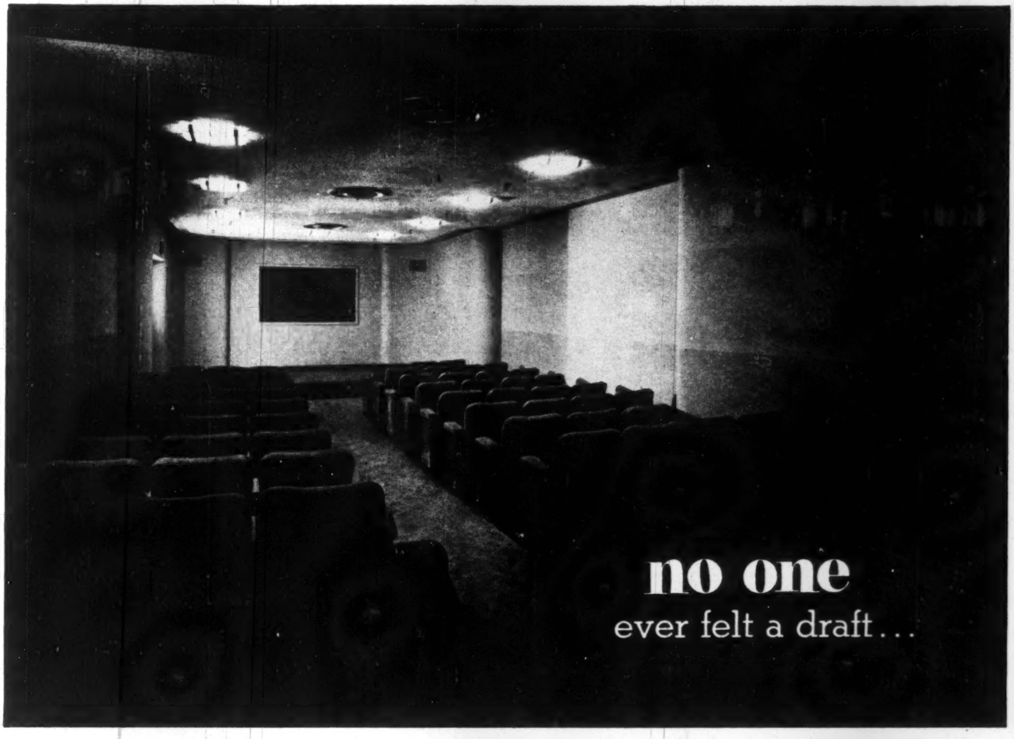
Take the first step in trying these better controls. Get the *new* PENN Condensed Catalogs . . . one on heating and the other on refrigeration controls . . . they're FREE. Ask your wholesaler or write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ontario.

PENN

AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

THE UPJOHN COMPANY's new manufacturing building in Kalamazoo, Michigan. Auditorium, cafeteria, employee lounge and offices are air conditioned and use Kno-Draft *Adjustable* Air Diffusers throughout. *The Austin Company, Engineers and Builders.*



from a kno·draft adjustable air diffuser

No. 1 reason why so many Kno-Draft *Adjustable* Air Diffusers are being specified and installed these days is because they do their job right. Soundly engineered and uncomplicated in operation, they distribute air evenly and *without drafts.*

No. 2 reason is beauty. Dynamically simple in design, Kno-Draft *Adjustable* Air Diffusers are "at home" in any surroundings—whether left in their natural spun aluminum finish or painted to match the ceiling.

No. 3 reason is adjustability *after* installation. This saves an enormous amount of slide rule figuring. A simple screw-driver adjustment balances temperature and air distribution throughout the conditioned area.

No. 4 reason is customer satisfaction. Users *like* the results they get with Kno-Draft *Adjustable* Air Diffusers. There are types and sizes to meet every need.

NEW EDITION! KNO-DRAFT DATA BOOK now in new 32-page format. Complete up-to-the-minute specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. Bring your files up to date. Mail coupon today.

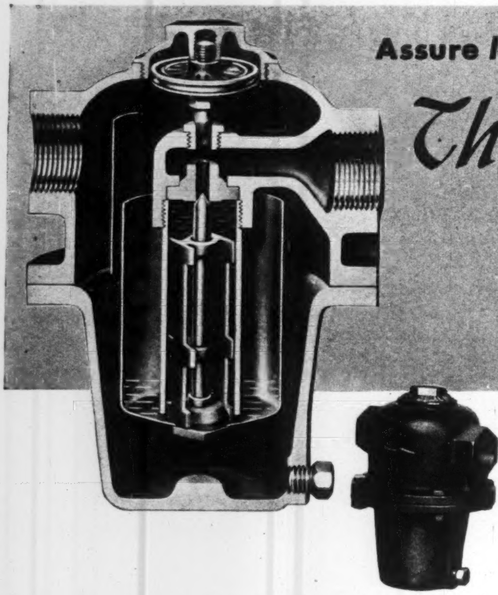
TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W.B.CONNOR ENGINEERING CORP.
Danbury, Connecticut
AIR diffusion · purification · recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. G-32, Danbury, Connecticut
Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

Name..
Position..
Company..
Street..
City....................**Zone**..........**State**..........

ILLINOIS
Float & Thermostatic TRAPS



Assure *lower* return line temperatures

They're different!
-in construction
-in performance

ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

"Buffalo"
MODEL "G"
AIR CONDITIONING
CABINETS
BULLETIN NO. 3703A
BUFFALO FORGE COMPANY
BUFFALO NEW YORK
CANADIAN BLOWER & FORGE CO., LTD. KITCHENER, ONT.

Just Off the Press!

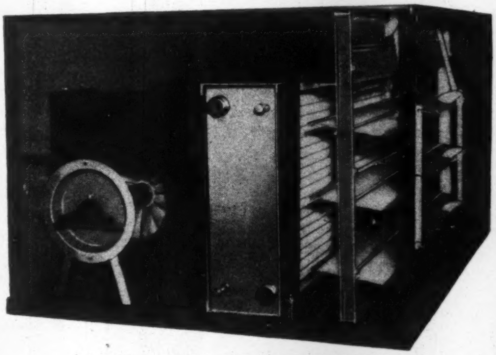
**HERE'S VALUABLE
UP-TO-THE-MINUTE
INFORMATION**
To Help You Solve Your
**AIR CONDITIONING
PROBLEMS!**

Write
FOR YOUR COPY TODAY

- Here is information on the very latest developments by "Buffalo" — the new model "G" Air Conditioning Cabinets. Bulletin 3703A explains fully, by detail photos, diagrams, charts and tables, what these units can do for you.

You'll be interested in the developments in these new "Buffalo" units. External appearance is clean and modern. The light, efficient "mixed-flow" fans are stable in performance over a wide range of capacities and pressures. Sectionalized construction and standardized parts make for easy installation, simple maintenance and flexibility of combinations. The new model "G" Vertical Type "VPC" Cabinet is in three easy-to-assemble parts — blower head, coil section and pan — easy to move thru ordinary building openings — and uses flat type Hi-velocity filters, which greatly reduces the space requirements of the unit. Both Vertical and Horizontal cabinets may be equipped with Air Washer sections, and any air conditioning function or combination of functions can be had.

For helpful information on your air conditioning problems, write today for Bulletin 3703A, on your company letterhead.



"Buffalo" Model "G" Type "PC" Cabinet with side panels removed. Simple cooling, cooling and dehumidifying, heating and humidifying, continuous cleaning — are available functions in these cabinets.

"Buffalo"
**FIRST
FOR FANS**

BUFFALO FORGE COMPANY
171 Mortimer St. BUFFALO, NEW YORK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Sales Representatives in all Principal Cities

VENTILATING **AIR WASHING** **AIR TEMPERING** **INDUCED DRAFT** **EXHAUSTING**
FORCED DRAFT **COOLING** **HEATING** **PRESSURE BLOWING**

The Modern Answer to Commercial Heating . . . at low cost, without smoke!

MOTOR STOKOR

CROSSFEED

TRADE MARK

AUTOMATIC ANTHRACITE BURNER

MotorStokor Crossfeed shown with automatic bin feed. Capacities to 300 pounds per hour per single unit.

The MotorStokor Crossfeed Burner is a tested and outstanding development in modern commercial heating. Designed for Anthracite Rice and Buckwheat—the Economy fuel.

Nothing can match these advantages . . .

★ *All operating adjustments are made from the outside without disturbing the fire.*
★ *Simple, with relatively few moving parts.*
★ *No moving parts in the high temperature zone.*
★ *Positive over-load release to protect the unit from damage.*
★ *No expensive boiler alterations required.*
★ *Unusual flexibility—may be mounted on either or both sides of boiler.*
★ *Available with hopper or automatic bin feed.*
★ *Rapid acceleration from bank to full output.*
★ *Low power requirements.*
★ *Guaranteed economy from low cost rice and buckwheat anthracite.*

You'll want all the facts on this MotorStokor Crossfeed when you are selling or specifying commercial heating equipment . . . write for complete details today.

MotorStokor Division
HERSHEY MACHINE & FOUNDRY CO.
523 Cherry St., Manheim, Pa.

For hot water tanks and heaters

Here is our answer to the call for a thoroughly dependable, highly accurate temperature limiting valve having real discharge capacity to guard against the hazards of scalding high temperature domestic water. The new McDonnell No. 201 Temperature Relief Valve is designed to open at precisely 188°F and reach maximum capacity at 208°F. It is for a maximum operating Pressure of 125 lbs. and is A.G.A. tested, rated and listed for a heat input of 1,200,000 Btu/hr.

> *The No. 201 has 1,200,000 Btu/hr capacity at A.G.A. minimum test water pressure of 30 lbs. It should be kept in mind that this rating is based on water discharge because the successful operation of any temperature relief valve assumes adequate cool water replacement. If for any reason the water supply fails, temperature and pressure can continue to climb in spite of the temperature relief valve. Therefore, a proper regard for safety suggests the addition of an ASME pressure relief valve, rated in terms of steam discharge capacity, like the McDonnell No. 33 Series Btu-rated safety relief valves.*

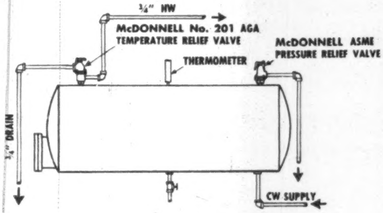
Extreme accuracy. For positive and precise valve operation, the No. 201 utilizes a newly developed adaptation of the well-known Vernatherm thermostatic element. Exhaustive laboratory and field tests have shown that when the temperature of the water surrounding this thermostatic element reaches 188° F this valve *will* open and discharge its maximum capacity at 208°F. It reseats quickly at just a few degrees below opening temperature; valve closes drip tight at 183°F.

Excessive temperature does not damage this element or vary its calibration; changes in barometric pressure do not effect its operation. In basic conception and ingenuity of design the No. 201 achieves a marked advance in temperature relief practice.

A further contribution to accuracy is found in the design provision for locating the No. 201 right in the flow of hot water to the fixtures. Note in the installation diagram that the No. 201 has, in addition to the tank and drain tappings, a tapping for the hot water supply line. As a result, service water can be arranged to flow directly through the valve and around the thermostatic element, assuring more accurate and rapid response to temperature. Utilization of the built-in fixture connection provides an automatic arrangement for eliminating any air accumulation around the temperature element, thus permitting the valve to open at the set calibrated temperature.

Thoroughly dependable. The simple, rugged, quality construction assures dependable service. Free flowing waterways through the valve provide generous clearances to prevent clogging. The Vernatherm element is hermetically sealed and exerts a powerful opening and closing force.

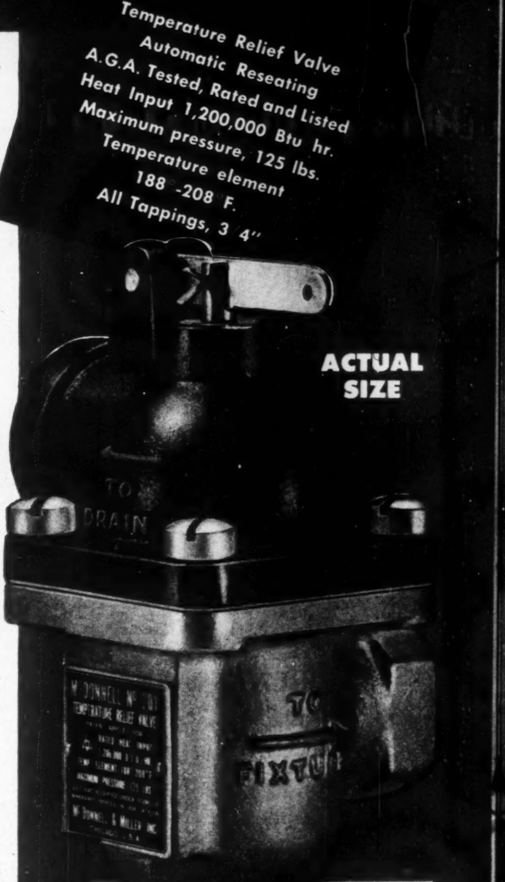
Complying with A.G.A. requirements, all parts of valve which are actually in contact with water are non-ferrous materials. Body is heavy brass casting. A distinguishing feature is the pull-down testing lever which provides a convenient means of testing or flushing out the valve.

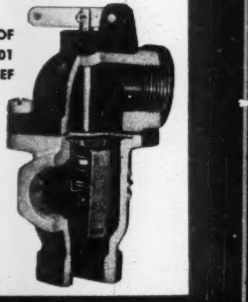

¾" HW
McDONNELL No. 201 AGA TEMPERATURE RELIEF VALVE
McDONNELL ASME PRESSURE RELIEF VALVE
THERMOMETER
¾" DRAIN
CW SUPPLY

A new bulletin tells the whole story of the McDonnell No. 201

McDONNELL & MILLER, Inc., 3500 N. Spaulding Ave., Chicago 18, Illinois

Doing One Thing Well

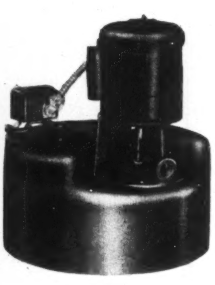




INTERIOR VIEW OF McDONNELL No. 201 TEMPERATURE RELIEF VALVE.

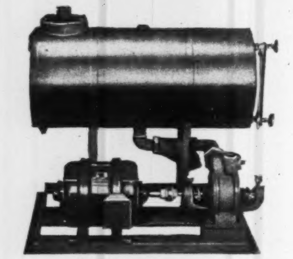
Boiler Safety Devices

SKIDMORE PUMPS
For Every Requirement

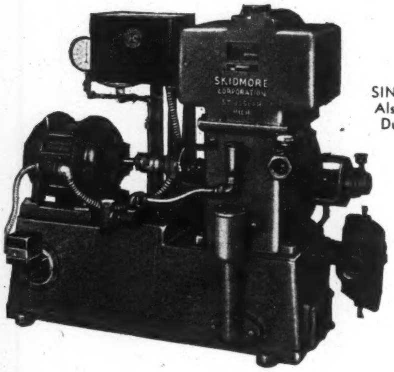


TYPE CV VERTICAL PUMP — A sturdy package type condensate unit. Pump housing and motor are integral casting bolted to top of receiver—it can be installed in limited space—on floor level or in pit. Capacities range from 500 to 10,000 sq. ft. E.D.R. and discharge pressures from 10 to 20 pounds.

MAINTAINED
SKIDMORE
PUMPS
EFFICIENCY

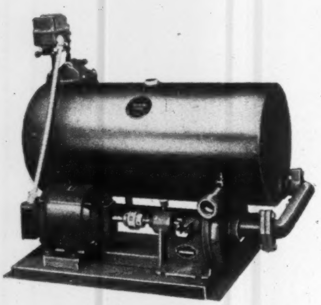


TYPE TM PUMP — The Skidmore High Pressure Turbine Type Pump is designed with motor and steel receiver, completely assembled and mounted on either steel or cast iron base as desired. Pressures up to 150 pounds and boilers to 250 H.P.



SINGLE UNIT
Also made in
Duplex Unit

SKIDMORE VACUUM PUMP — Automatically adjusts itself to the varying conditions of the system. Liberal clearance between moving parts means Maintained Efficiency. Capacities ranging from 5,000 to 10,000 sq. ft. E.D.R.



TYPE HS PUMP — Highly efficient pump economically designed, mounted on steel base, also furnished with cast iron base and cast iron receiver. Pump is bronze fitted throughout. Capacities ranging from 1,000 to 65,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 pounds.

DESIGNED TO SUIT YOUR PARTICULAR REQUIREMENTS. A SKIDMORE HEATING PUMP WILL GIVE YEARS OF DEPENDABLE SERVICE.

TYPE UV
CONDENSATE
PUMP

Use wherever the condition necessitates underground installations or low returns — sturdily constructed in either single or duplex units. Vertical pump and motor assembly has float and float switch mounted on cover plate and is bolted to sump type receiver. Capacities ranging from 2,000 to 40,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 pounds.

SKIDMORE CORPORATION, DEPT. IA, ST. JOSEPH, MICHIGAN

Send complete engineering bulletins on the following Skidmore Heating Pumps checked below.

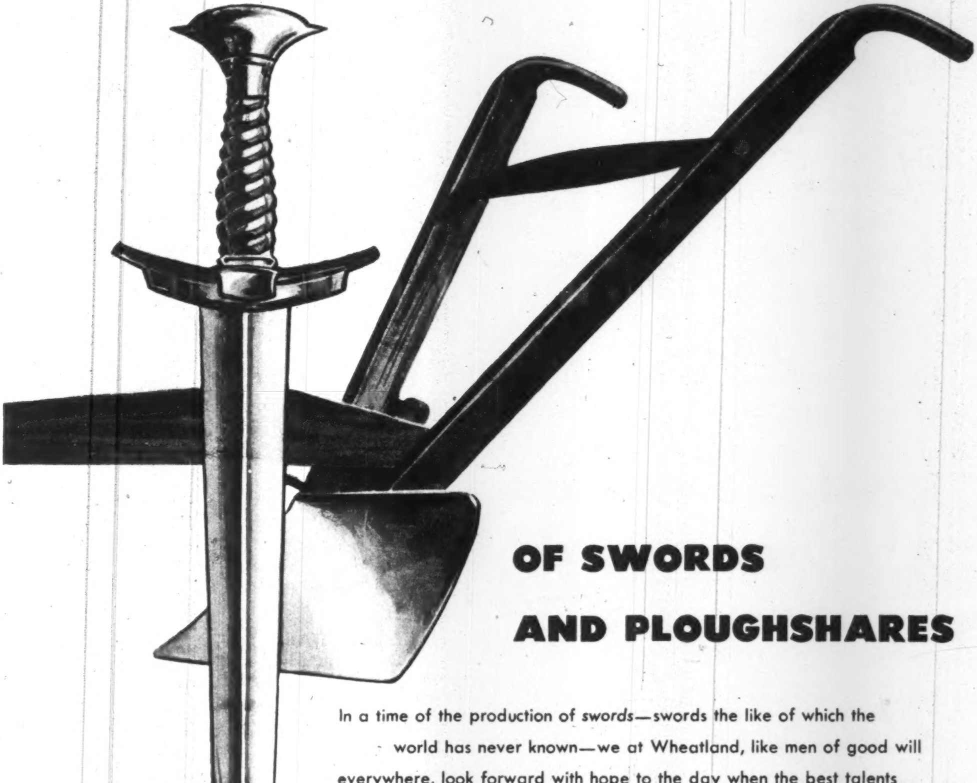
UV	VC	CV	TM	HS	SUMP PUMP	VACUUM PUMP

Name .... Position ....

Company ....

Street .... City .... State ....

Want complete engineering data? SEND COUPON



OF SWORDS AND PLOUGHSHARES

In a time of the production of *swords*—swords the like of which the world has never known—we at Wheatland, like men of good will everywhere, look forward with hope to the day when the best talents and energies of the nation can once again be devoted to the production of *ploughshares* . . .

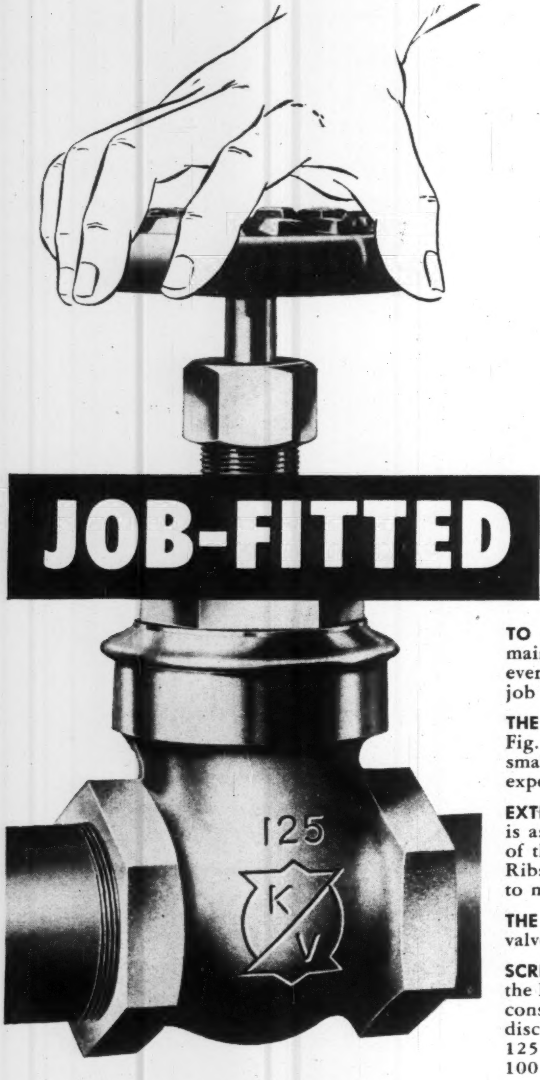
Meanwhile, to hasten the coming of that day *when nation shall not lift up a sword against nation, neither shall they learn war any more,* we are doing our utmost to help speed the flow of power and energy so vitally needed to keep the free world strong—and free.

WHEATLAND-52

-pipe with the yearmark!

WHEATLAND TUBE COMPANY
BANKERS SECURITIES BLDG., PHILADELPHIA 7, PA.

Scrap is needed in greater quantities than ever before. Do your part—get in the scrap today!



KENNEDY

bronze gate valves . . .

for low-cost maintenance

KENNEDY FIG. 27, Bronze Gate Valve
125 lbs. steam, 200 lbs. WOG, non-shock

WRITE FOR CIRCULAR 102
BUY FROM YOUR LOCAL DISTRIBUTOR

TO ASSURE DEPENDABLE OPERATION with minimum maintenance, the complete Kennedy Line is *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

THE SIMPLE, STURDY DESIGN of the rugged Kennedy Fig. 27 Bronze Gate Valve, for example, eliminates the small, quick-wearing parts that can cause frequent repair expenses.

EXTRA TIGHTNESS, without undue wear on the packing, is assured by an unusually deep stuffing box. Stripping of the stem and disc threads is practically impossible. Ribs cast on inside of valve body fit into channels in disc to maintain straight-line operation of all moving parts.

THE STUFFING BOX is provided with gland, and the valve can be repacked under pressure when wide open.

SCREWED BONNET AND WEDGE DISC are standard on the Fig. 27 in sizes from ¼ to 3 inches. Larger sizes are constructed with bolted bonnets and cam-type double discs with parallel seats. Working pressures ¼" thru 3": 125 lbs. Steam, 200 lbs. WOG, non-shock. 3½" thru 6": 100 lbs. Steam, 150 WOG, non-shock.

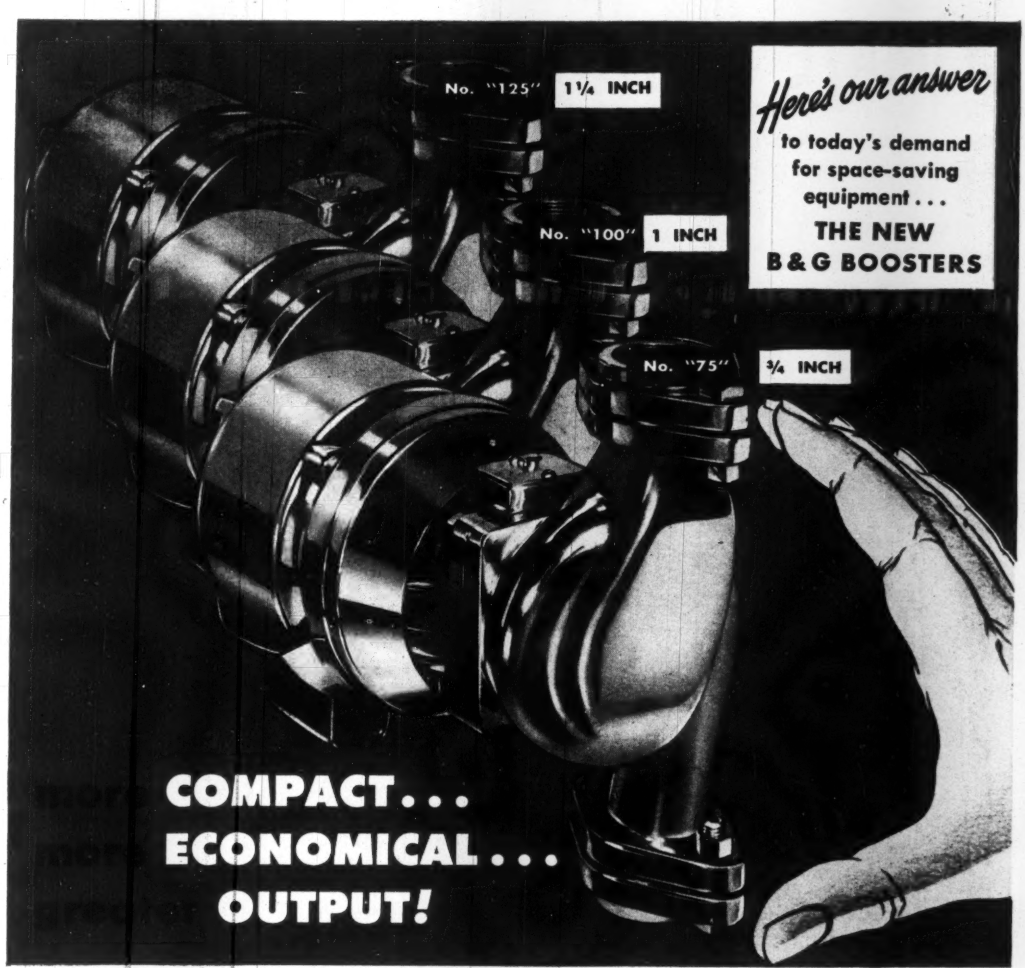
TO SAVE TIME AND TROUBLE, the Fig. 27 is *job-fitted* for easier installation, too. Wide, heavy pipe-end hexes have generous chamfer and precision threading . . . help you make tight connections quickly and easily.

FOR BEST RESULTS and real economy, standardize on Kennedy Bronze Valves . . . and the complete line of Kennedy Iron Valves, Malleable, Cast-Iron and Bronze Pipe Fittings.

KENNEDY
JOB-FITTED
VALVES
Est. 1877

THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS



All the famous B & G Booster features in smaller, lighter units

Today's trend to smaller homes makes it imperative that operating equipment be made as small as possible. This new series of B & G Boosters was designed specifically to answer your requests for more compact, space-saving units.

The small 1/12 H.P. motor, designed and built in the B & G plant, consumes less current . . . keeps operating costs at a minimum. Ideal in every respect for residential installations or for zoned jobs where individual circuits are comparatively short in length.

Important, too, is the conservation of critical metals. The smaller sizes of B & G "75"—"100" and "125" Boosters permit more units to be produced from any given allotment.

Nearly a quarter of a million of these new-design Boosters are installed at the present time. Their performance has proved the soundness of B & G engineering —you can install "75", "100" and "125" Boosters with complete confidence in their efficiency and dependability.

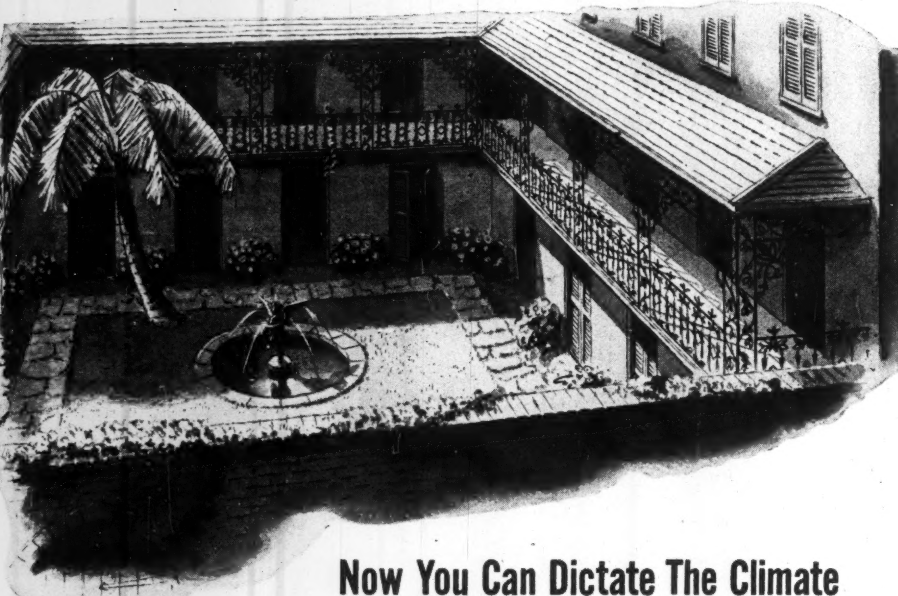
Famous builder of small homes says—
"These are the pumps for us—they are ideally suited to our small home designs. We never could see the idea of a large, overpowered pump to do the job required by a few hundred feet of radiation. Congratulations on the way you have answered a growing problem."

*Reg. U. S. Pat. Off.

B & G

BELL & GOSSETT
COMPANY
Dept. C-K5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

CLIMATE DICTATED THIS HOUSE



Now You Can Dictate The Climate
With YORK RESIDENTIAL AIR CONDITIONING

York Residential Air Conditioning makes it possible for you to ignore the demands of climate in designing and building houses of even modest outlay. Taste alone determines your design.

York enables you to provide for all-year, trouble-proof residential air conditioning in every type and size of residence—at lowest possible first costs, and lowest possible operating costs.

The York Residential Air Conditioner can be teamed to work efficiently with any forced-warm air heating plant or, with a minimum of ductwork, operated independently. Unusually adaptable, it can be installed easily and economically in cellar, attic, service closet or garage . . . in houses already existing or now under construction.

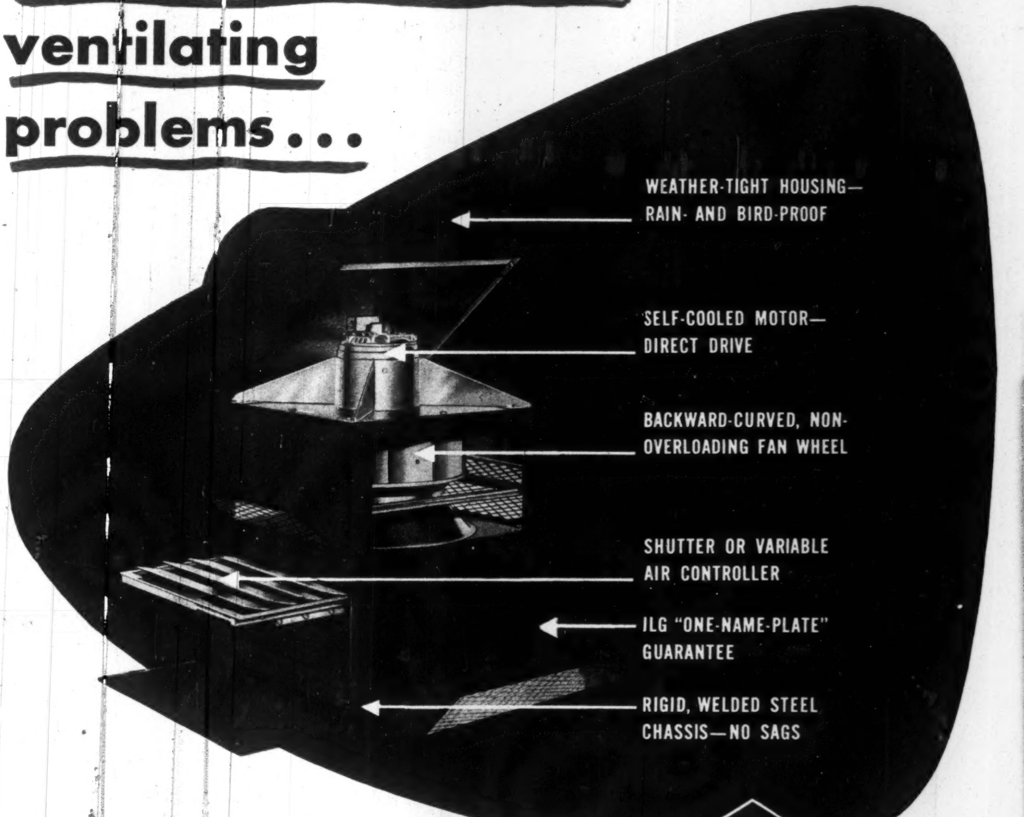
Let your York Representative save you time and details in your air conditioning planning. Consult him today (he's listed in the Classified Directory) or write York Corporation, York, Pennsylvania.

York
refrigeration
air conditioning

The big advances come from YORK

Headquarters for— **Refrigeration and Air Conditioning**

Your answer to tough ventilating problems . . .


WEATHER-TIGHT HOUSING—RAIN- AND BIRD-PROOF
SELF-COOLED MOTOR—DIRECT DRIVE
BACKWARD-CURVED, NON-OVERLOADING FAN WHEEL
SHUTTER OR VARIABLE AIR CONTROLLER
ILG "ONE-NAME-PLATE" GUARANTEE
RIGID, WELDED STEEL CHASSIS—NO SAGS

New ILG "PRV" power roof ventilators . . .

Acceptance of this new product has far exceeded our most optimistic expectations. Architects, engineers, and contractors have been quick to recognize its value. Today, many hundreds of these self-contained ventilating units can be seen on roofs of new hospitals, schools, armed service bases, and industrial buildings throughout the nation. If *you* haven't heard the complete story on these "PRV" units, call in your nearby ILG representative today. Have him show you why you get positive, controlled ventilation, regardless of wind or weather conditions, through vertical flues or duct systems. Have him explain the numerous extra features you get in this high quality product that doesn't require one inch of valuable indoor wall or floor space. With Branch Offices in over fifty principal cities, your experienced ILG engineer is as close as your telephone. Phone him today (consult classified directory), or send coupon.

ILG
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VENTILATION

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Free! **New engineering data bulletin No. 1901 gives you the complete story—features, sizes, capacities, dimensions. Send coupon now!**

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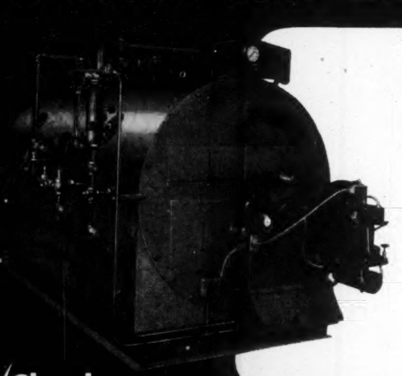
SAVE FUEL-SAVE LABOR-
Choose Dutton!

TWO LINES TO SUIT YOUR NEEDS . . . BOTH FAMOUS FOR EFFICIENCY . . . LONG LIFE . . . LOW OPERATING COST



*Econo*THERM . . .

the compact, automatic "packaged" boiler with exclusive Off-Center Firing

Compare it point-by-point — and you'll see *why* the EconoTHERM's advanced engineering *pays off* in fuel and labor saved! Off-Center Firing results in faster steaming and greater safety with guaranteed 80% efficiency. Completely automatic . . . amazingly compact . . . 5 or more square feet of heating surface per H.P. Gas or oil fired — to 250 H.P. Write for EconoTHERM Bulletin

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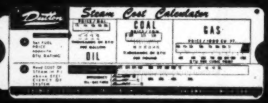
OTHER TYPES AND SIZES
5 H.P. AND UP

*Econo*MIST . . .

gives you 5-way firing convertibility . . . plus reliable H. R. T. design

Install it for gas, light oil, heavy oil, stoker, or hand firing — you can later convert the EconoMIST to *any* one of these firing methods. Highly adaptable, it's above all tremendously *dependable*. Of all "packaged" units, EconoMIST sets the standards for operating simplicity and low maintenance costs. Sizes from 15 to 105 H.P. Write for EconoMIST Bulletin EC-100G



Handy Steam Cost Calculator mailed FREE on request . . . or ask your Dutton representative. (See Yellow Pages in Phone Book.)

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DIVISION
HAPMAN-DUTTON COMPANY
KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

Combination Gas Valve & Safety Pilot

Combining a solenoid gas valve with high plunger force and positive closure, with the White-Rodgers liquid-filled, automatically recycling safety pilot, these controls provide one compact assembly for greater simplicity of installation and wiring because electrical connections are already made. Also available with manual operator for use in event of power failure. One of many in the comprehensive line of White-Rodgers automatic controls for modern gas heating. *Write today for complete catalog.*

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WR *Controls*

FOR REFRIGERATION
HEATING AND
AIR CONDITIONING

SEND FOR THE NEW PK 40 PAGE WATER HEATER CATALOG

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Patterson-Kelley Co.

p-k catalog No. 202 provides you with a simple, rapid means of selecting the correct hot water heater for forced circulation. Capacities from 95 to 101,000 gph. Steam pressures range from 0 to 100 psig. Standard "U" Tube Heaters are available in 2- 4- or 6-pass construction. Water temperatures range from 40° to 100°F. inlet and 80° to 300°F. outlet.

other TAB INDEX FEATURES

- **Condensate Cooler tables**
- **Dishwater Booster Heater tables**
- **Gravity circulation tables**
- **Hot Water Service Heater tables**
- **Pressure drop tables**
- **Typical piping arrangement**

1035

the PK please send **p-k** catalog 202

Patterson-Kelley Co., Inc.

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Name Position

Company

Street City State

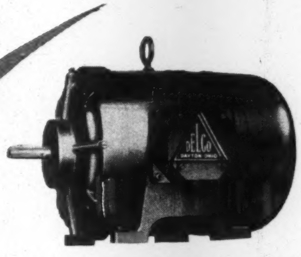
where power is part of the product, you're *right* with a

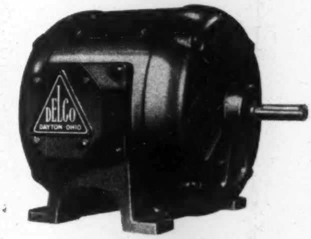
DELCO

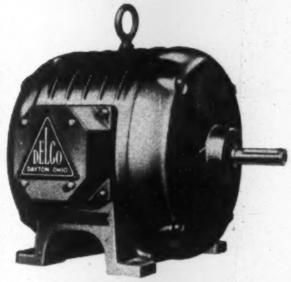
When you need motors—to serve as a *part* of your product or to help you *make* your product—look to Delco for the motors that will serve you best.

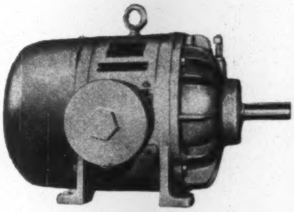
Delco produces motors for practically every known purpose . . . and each Delco motor is *engineered* for the kind of work it has to do. It's made of the finest materials, and constructed to stand up longer under the roughest conditions.

So check on Delco. You'll find Delco motors fit your needs, and that Delco always delivers on time. For complete details, write to Delco Products, Dayton, Ohio, or call the nearest sales office listed below.


TOTALLY ENCLOSED FAN-COOLED MOTOR


OPEN BALL-BEARING MOTOR


TOTALLY ENCLOSED MOTOR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New, Fast-Acting, Automatic
"SMOKE-FIRE DETECTIVE"

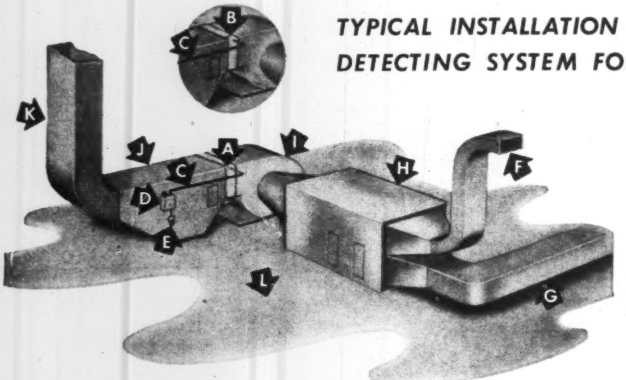
For Air Conditioning

Smoke in your air conditioning spreads fast . . . causes panic, spoilage and needless expense . . . now all can be avoided by installing a modern, fully approved C-O-TWO Automatic Smoke Detecting System.

Smoke, smoldering and fire are spotted in the incipient stage anywhere throughout the air conditioning ducts, as well as via the return air from air conditioned spaces. Four types of smoke detectors and several different installation arrangements are available to fit your particular needs . . . for small air conditioning units, for large air conditioning systems, and whether with or without electrostatic precipitators. All C-O-TWO Automatic Smoke Detecting Systems function by drawing continuous air samples through simple piping to a smoke detector. The first trace of smoke sets off an alarm, based on an exclusive operating principle . . . no chance of smoke spreading . . . the air conditioning instantly shuts down, dampers close and fire extinguishing systems actuate.

Act now for complete free information and descriptive literature on this newest contribution to modern fire fighting. An expert C-O-TWO Fire Protection Engineer will be glad to help you in planning economical, fully approved fire protection facilities without obligation. (Special assistance rendered to qualified air conditioning contractors.)

TYPICAL INSTALLATION C-O-TWO AUTOMATIC SMOKE DETECTING SYSTEM FOR AIR CONDITIONING DUCTS



A perforated smoke accumulating pipe
B smoke accumulating pitot tube (alternate)
C pipe line for carrying continuous air samples to smoke detector
D smoke detector
E audible alarm
F fresh air intake and duct
G return air duct
H air cleaning unit
I air fan
J air cooling and heating unit
K supply air duct
L floor level

TRADE MARK
C-O-TWO
REG. U.S. PAT. OFF.

C-O-TWO FIRE EQUIPMENT COMPANY
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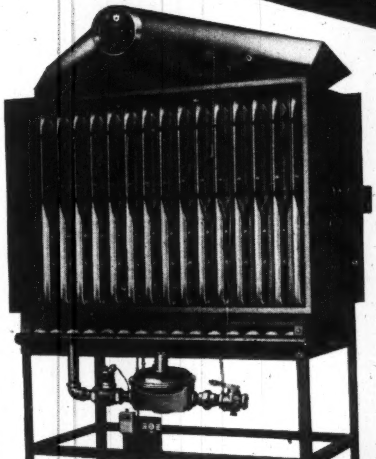
Sales and Service in the Principal Cities of United States and Canada
Affiliated with Pyrene Manufacturing Company

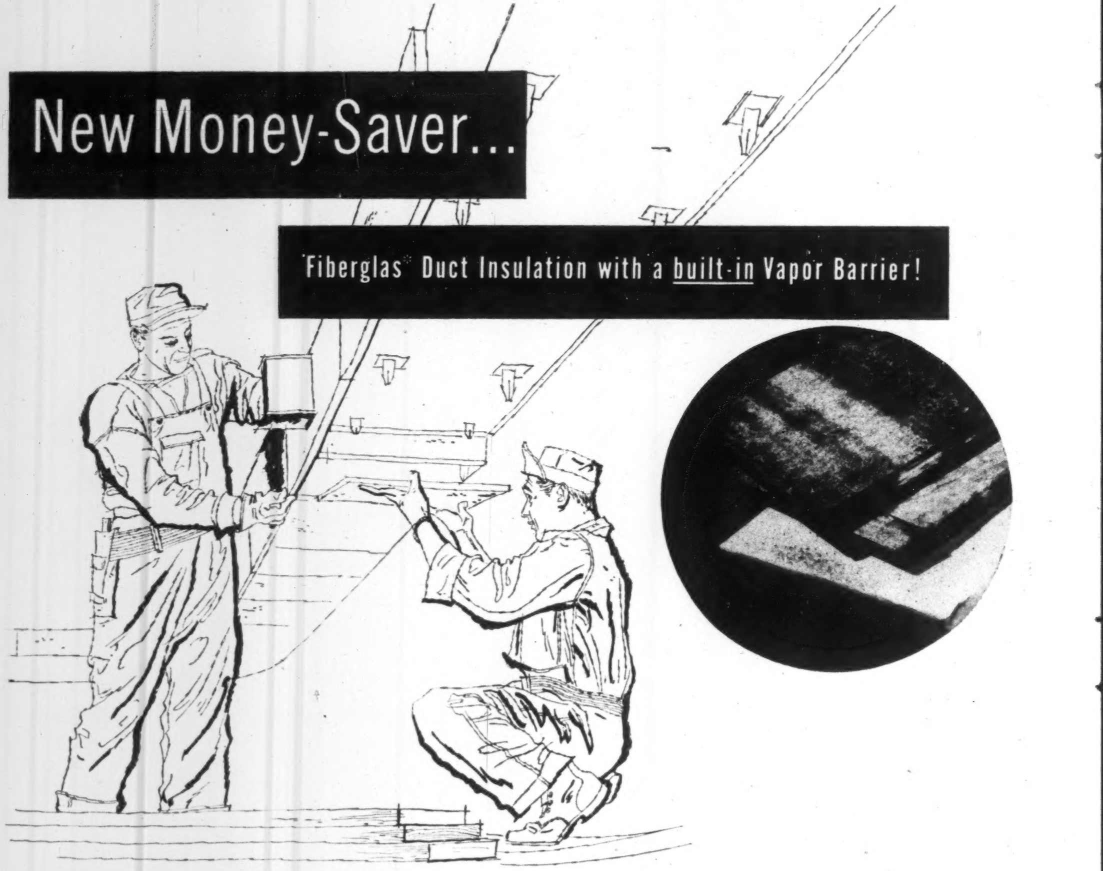
MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT
Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers • Built-In Smoke and Heat Fire Detecting Systems
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems



MOD

New Money-Saver...

Fiberglas* Duct Insulation with a built-in Vapor Barrier!



Why spend extra money to apply insulation and vapor barrier *separately* . . . when the whole job can be done in *one operation* with Fiberglas Vapor-Seal Duct Insulation?

This entirely new material performs many functions. Besides doing an efficient job of thermal insulation and noise deadening on cool air ducts, it stops damaging condensation with a factory-applied vapor barrier of asphalt and kraft paper. All joints and application perforations, if any, must be sealed. Weighing but 8 oz. per sq. ft. (1" thick), Vapor-Seal Duct Insulation is easy to handle, and low in application cost.

Where heat or cold must be controlled, count on these unique features of Fiberglas Industrial Insulations to produce top results . . . in less time, at lower cost:

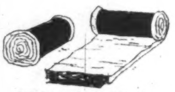
- **High insulating value**
- **Light, easy to apply**
- **Economically priced**
- **Non-combustible base**
- **Ageless, rotproof**
- **Non-corrosive**
- **Low moisture pickup**
- **Dimensionally stable**

Your Fiberglas Insulation Contractor can help you make the most of these advantages. For his name, phone your nearest Fiberglas Office. Or write OWENS-CORNING FIBERGLAS CORP., Department 40-C, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS

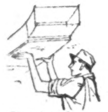
INDUSTRIAL INSULATIONS

...Where Heat or Cold Must be Controlled!

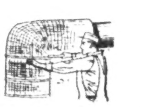


TW-F Insulating Wool

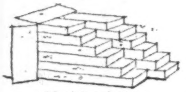
PF Pipe Insulations



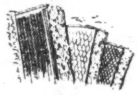
Duct Insulations



Blanket Pipe Insulations



Block Insulations



Metal Mesh Blankets

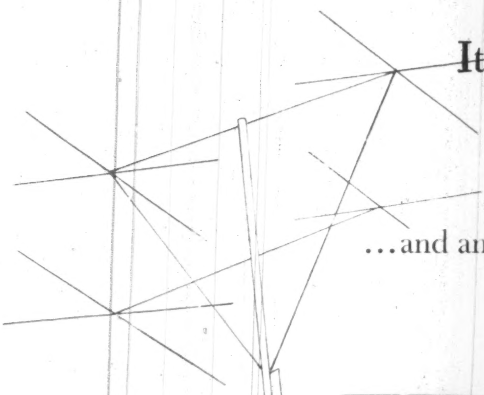
Low-Temp. Insulations

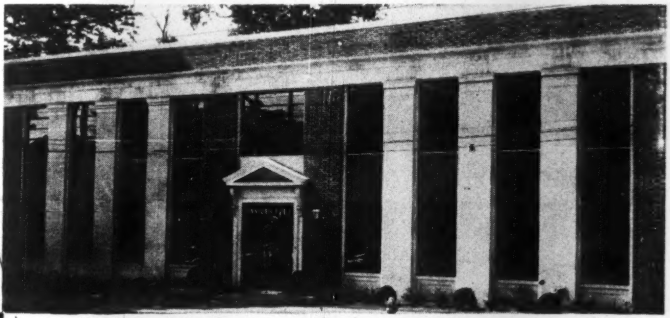
Insulating Cement

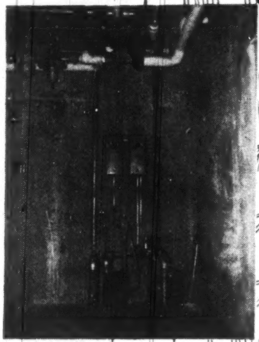
*Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

It's the Southeast's finest Radio-Television Building

...and another **SPANG CW** installation



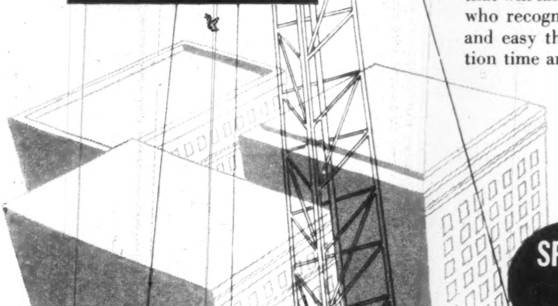




Completely air conditioned, fire-resistant and insulated against sound, this modern, new building for Station WAGA, Atlanta, is an unusually well-designed radio-television center.

Incorporated are the very latest advanced ideas for AM, FM and TV broadcasting, including new technical features, a wide variety of studios, even a darkroom. And—*because absolute reliability was so important for heating and air conditioning*—Spang Pipe in sizes from ¾" to 3" was specified for these services.

Always uniform in every respect, *quality-controlled* Spang Steel Pipe is consistently the first choice of careful architects, engineers and owners who are looking for pipe that will last longer. First choice, too, of smart contractors who recognize how much the easy cutting, easy bending and easy threading characteristics can cut their installation time and costs.



Owners: The Fort Industry Co., Atlanta
Architects: Ivey & Crook, Atlanta
General Contractors: Concrete Builders, Inc., Atlanta
Piping Contractors: Seckinger Sons Company, Atlanta

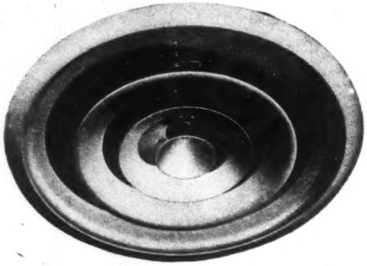
SPANG

SPANG-CHALFANT

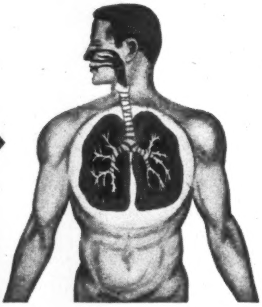
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Grant Building, Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

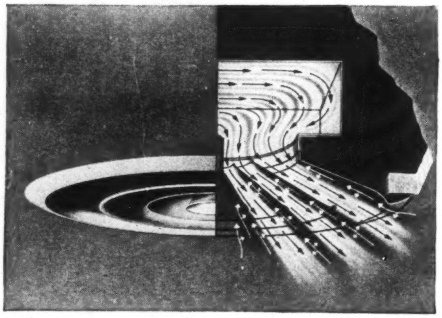
Anemostat Air Diffusers...



actually "breathe"...



to give you conditioned comfort



The familiar process of breathing dramatically illustrates the Anemostat principle of aspiration. Just as we inhale air, mix it within our lungs and expel it, so Anemostat air diffusers also aspirate . . . by drawing room air *into* the unit and mixing this room air with supply air *within* the outlet before distributing the mixture in many planes traveling in *all* directions.

This aspiration effect eliminates uncomfortable drafts and stale air pockets . . . equalizes temperature and humidity throughout the conditioned area.

Yes, breathing is essential to human life . . . and to the proper performance of heating, ventilating and air conditioning systems. Remember, only Anemostat air diffusers are designed to perform this vitally important function of aspiration.

ANEMOSTAT®

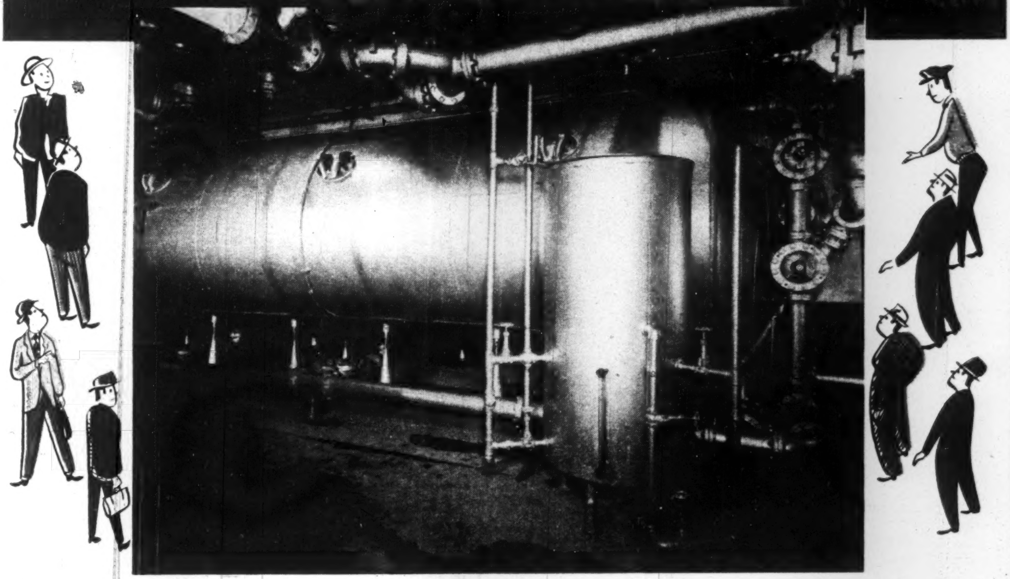
DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

AC-1284

where the EYES are this month!



Because of uninterrupted service the EYES this month are on the REFINITE Multi-cel Filter with Selective Automatic Valve Controls, installed in 1946 in the HOTEL PEABODY, Memphis, Tennessee. The installation was designed and supervised by the consulting engineering firm of Allen and Hoshall of Memphis. . . . The equipment that serves 625 rooms includes:

1—8' x 24' multical filter
1—90" x 144" Forced draft aerator
1—Pressure solution chemical feeder

All of the water used in the hotel is aerated and filtered. Capacity of the plant, 650 g.p.m. . . .

Water from well contains carbon dioxide and hydrogen sulphide which cause corrosion and odor. Aeration gets rid of these obnoxious qualities. Filtration following aeration removes oxidized iron, suspended matter, turbidity, etc. . . . The filter is automatic in operation. A timer control initrates back-washing and rinsing at preset intervals. More facts will be mailed you on request.

Refinite

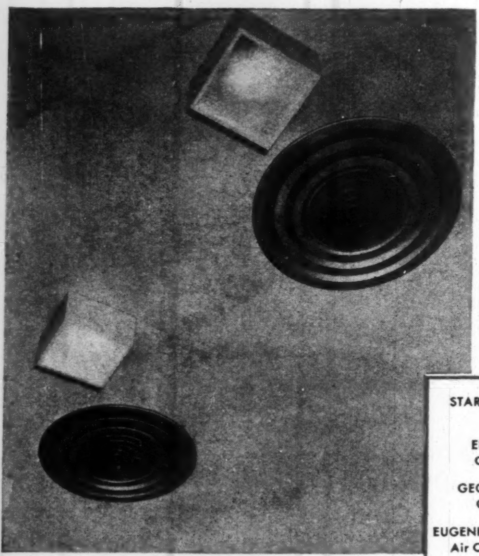
WATER REFINING EQUIPMENT
OMAHA, NEBR.

REFINITE *Serves the World*

. . . and Refinite wants to serve you, too! Regardless of your water treatment problem . . . iron, turbidity, hardness, bad taste or odor . . . you will find that Refinite has the Right Answer. Today, write or phone for new special bulletins that will answer many of your water conditioning questions and show how Refinite's Engineers can help you. No obligation. **ADDRESS: REFINITE CORPORATION, DEPT. HPA, P.O. BOX 1312, OMAHA, NEBR.**

P.S. Refinite also manufactures low cost, efficient units to soften water for individual homes. See your local dealer, or write for literature.

In America's outstanding buildings... you'll find engineered T&B products



Aerofuse

CEILING DIFFUSERS

STARRETT and VAN VLECK
Architects

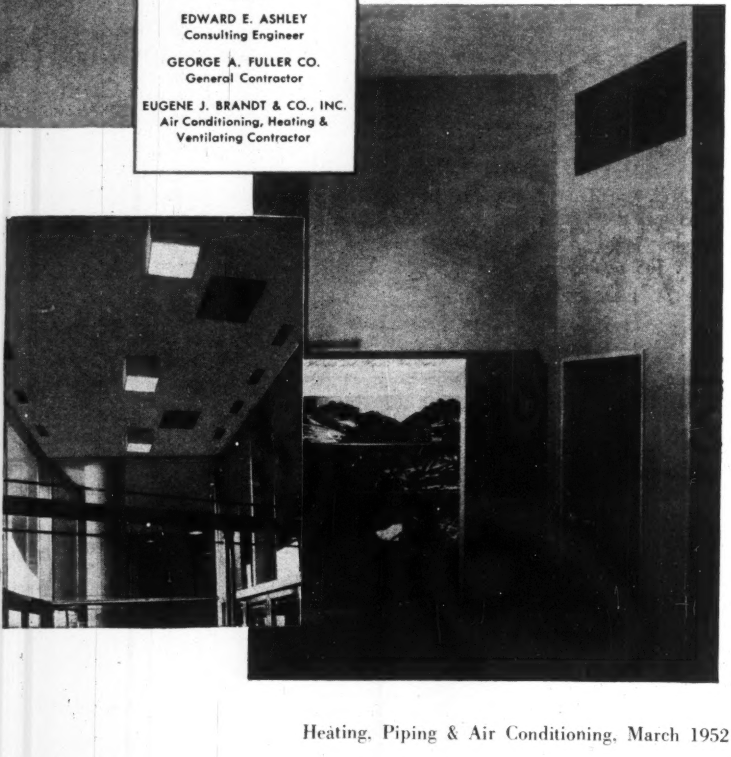
EDWARD E. ASHLEY
Consulting Engineer

GEORGE A. FULLER CO.
General Contractor

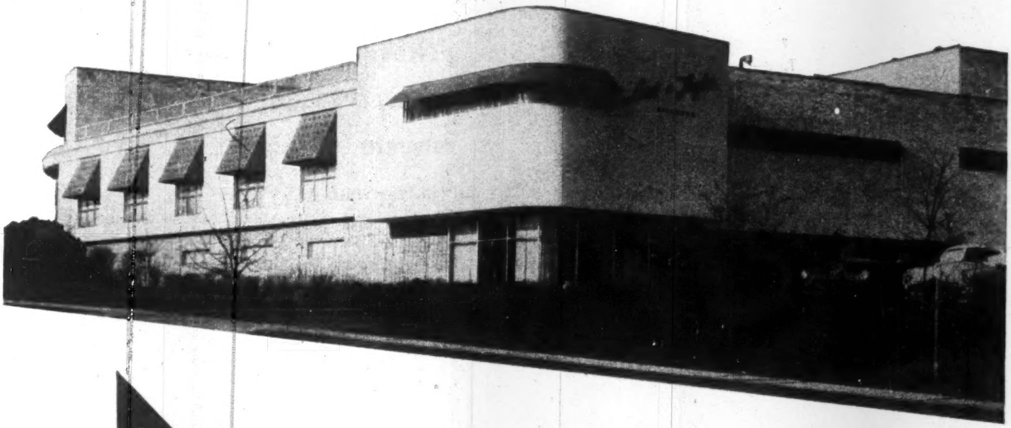
EUGENE J. BRANDT & CO., INC.
Air Conditioning, Heating &
Ventilating Contractor

Tri-Flex Aerovane

GRILLES and REGISTERS



INSTALLED AT THE VITAL POINT...OF AIR DELIVERY



IN LORD & TAYLOR'S NEW STORE
at Millburn, New Jersey

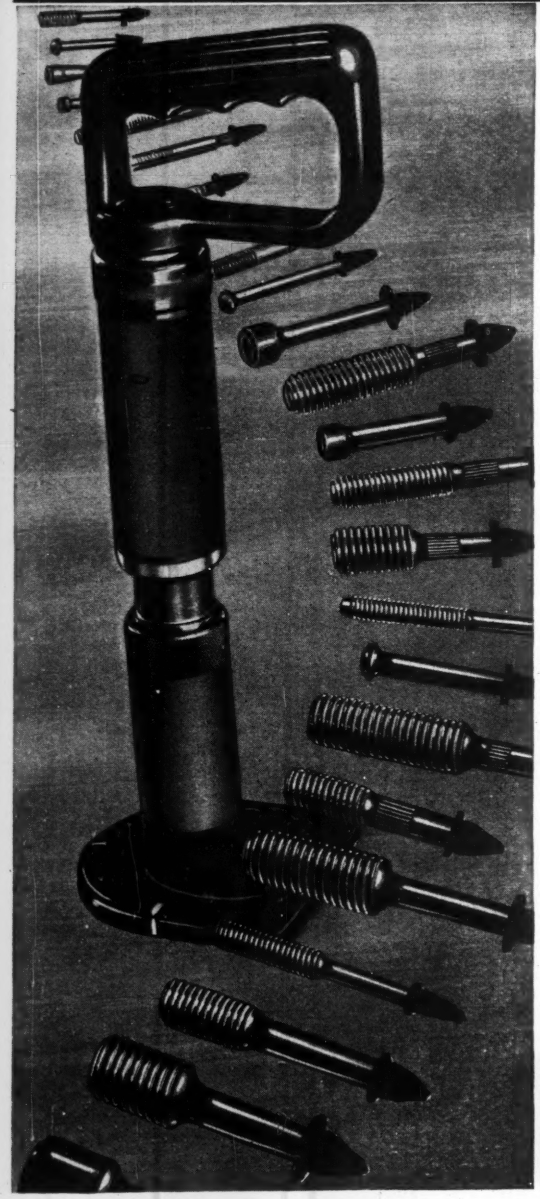
No effort has been spared to make this luxurious new Lord & Taylor suburban store a delight to customers as well as a model of good practice in management and operation.

That means efficient, dependable air conditioning performance with the most careful attention to precision adjustment and control at the vital point of air delivery. As in so many other distinguished buildings from coast to coast, the architects and engineers specified Aerofuse Diffusers and Tri-Flex and Aerovane Grilles and Registers. These famous Tuttle & Bailey products, backed by the Industry's most complete engineering and test facilities, insure the performance of the system while meeting every requirement for good taste in design.

Write for Catalogs No. 104 and 48S containing full information.

TUTTLE & BAILEY inc
NEW BRITAIN, CONNECTICUT

[illegible]



"Red-Tip Pilot" Line, at reduced prices, leads the way to still greater economies in steel and concrete fastenings . . .

"Better than ever" say heating, piping and air conditioning contractors, about the newly developed RAMSET® Tru-Set Fasteners. "They set straight as an arrow and slick as a whistle. With that Red-Tip Pilot and those reduced prices, we'll stick to RAMSET for our fastening work in steel and concrete, and wherever else we can use it."

Lower prices on this latest technological development are gained from the new design and greatly increased sales volume. Then, a close-to-perfect percentage of accurately-seated fasteners results from the elasticized Red-Tip Pilot, which guides the fastener *straight* through the barrel into the work. For construction fastenings, nothing sets like RAMSET.

Fasten $^{15}/_{1}$ Faster with RAMSET SYSTEM

You beat the time by 15 to 1 for most fastening jobs by using RAMSET SYSTEM instead of old-fashioned methods. If you are not already profiting from these time-saving, money-saving advantages, ask for demonstration. Our nationwide network of capable dealers provides fast, on-the-job service and suggestions. Take a moment now, to ask for details.

Ramset Fasteners, Inc.
Pioneer in powder-actuated fastening
12117 BEREA ROAD • CLEVELAND 11, OHIO

DON'T HAND SET...
Ramset WITH TRU-SET FASTENERS

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

16" Std. Ladish Ⓛ AWV
16" Std Ladish Ⓛ BCR

...to be sure of sound welds and fast assembly

Ⓛ TO MARK PROGRESS

Keeping welding costs down to a minimum and erection schedules on time... these are important advantages you can assure to any piping job by installing Ladish Controlled Quality fittings. Metallurgical controls over materials and methods provide an assurance of uniform weldability in every Ladish fitting... and thorough inspection to rigid standards of physical dimensions and geometric accuracy assures fast piping assembly.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF... ONE RESPONSIBILITY

LADISH CO.
CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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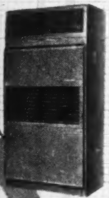
Quality-Engineered by

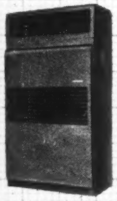
TYPHOON

DEPENDABLE EQUIPMENT FOR YOUR AIR CONDITIONING NEEDS

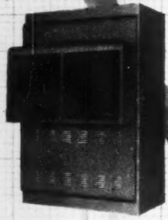
CONSOLE UNITS
SCO MODELS 1½-2-3

SELF-CONTAINED UNITS
SC MODELS 5 AND 81





SELF-CONTAINED UNITS
SC MODELS 82 AND 10

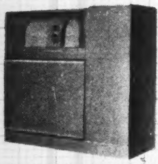


SELF-CONTAINED
(REMOTE) UNITS
SC MODELS
15 AND 20

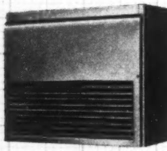
Whether the job calls for a single packaged air conditioning unit or a central plant . . . a packaged water chiller or a heat pump — you can count on Typhoon equipment to supply your needs. And Typhoon's quality engineering — backed by over 40 years of experience — is your guarantee of trouble-free performance.

Satisfied Typhoon users include famous companies like RCA, Grand Union Stores and Whelan Drug Stores. They've found Typhoon equipment tops in economical operation . . . tops in cooling efficiency. You will, too.

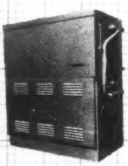
EVAPORATIVE
CONDENSERS
EC MODELS 3-5-8



EVAPORATIVE CONDENSERS
EC MODELS 10-15-20



AIR HANDLING UNITS



PACKAGED
WATER CHILLERS

HEAT PUMPS

ALSO — WINDOW UNITS, BOILERS, COILS AND MULTI-PACKAGED SYSTEM UP TO 60 TONS.

Write for Detailed Information

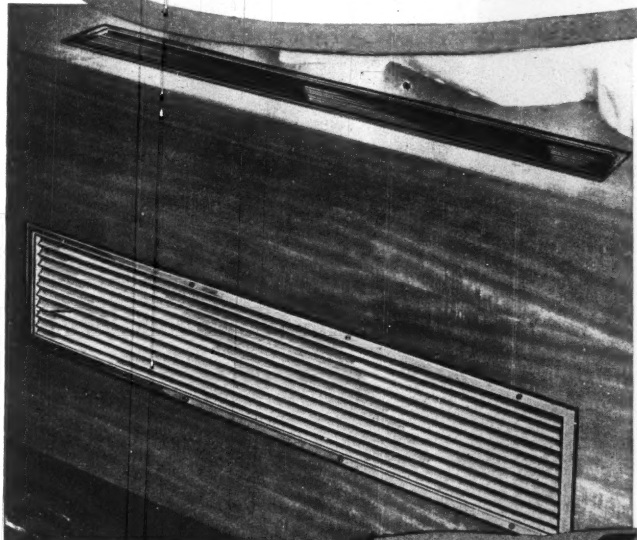
TYPHOON AIR CONDITIONING CO., INC.

794 Union Street, Brooklyn 15, N. Y.

Specialists in Air Conditioning Since 1909

INSTALL *Custom Designed* CONVECTOR GRILLES

without increasing your building costs



Above
Photo shows AIRFOIL convector grilles installed in John Hancock Building.

Architects—
Crame & Ferguson,
Boston, Mass.

Gen. Contractors—
Turner Const. Co.,
Boston, Mass.

Heating & Ventilating Engineers—
Buerkel & Co., Inc.,
Boston, Mass.

Sheet Metal Contractors—
Stanley E. Priggen Co.,
Boston, Mass.

- **EXTRA RUGGED**
  Made to *withstand heaviest use and abuse* which lower wall grilles must take.
- **TAMPER PROOF**
  No "see-thru". Extra-close spacing of louvers prevents gum wrappers—waste paper from being dropped between louvers.
- **EXTRA-HEAVY SUPPORT BARS**
  Heavy-duty steel bars on 6" centers give added strength where it is most needed.
- **MADE TO ANY SIZE**
- **OVER 70% FREE AREA**
- **EASILY INSTALLED**
  Precision built to fit snugly. Can be installed in marble, tile or other special surfaces.
- **EXTRA-WIDE BLADES FOR MOST EFFICIENT DEFLECTION OF AIR**
- **EACH DEFLECTING BLADE "HEMMED" FOR ADDED STRENGTH —ADDED SAFETY**
- **ALSO AVAILABLE WITH DAMPER AND KNOB CONTROL**

AirFoil

AIR CONDITIONING OUTLETS

AIRFOIL CUSTOMED CONVECTOR GRILLES are *built above and beyond average demand. Give air distribution performance that's above and beyond average—YET COST IS KEPT AT STANDARD PRICES.*

Superior construction and performance usually reserved for the highest-priced grilles are incorporated as standardized features of this great new line of convector grilles. *They meet the most exacting specifications of architects and engineers.*

AIRFOIL CONVECTOR GRILLES are better designed—more durable. Feature for feature, dollar for dollar—they cannot be duplicated. Made with a "decorator's touch," *they add new beauty to any installation.*

Free

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

☐ Air conditioning outlets
☐ Return air grilles and registers
☐ Volume controllers
☐ Perforated metal and ornamental grilles
☐ Door ventilators
☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

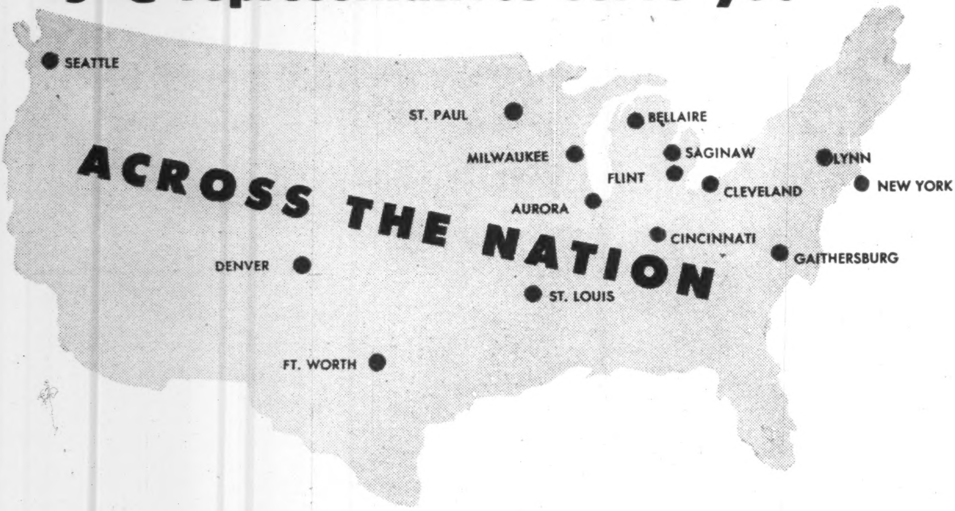
☐ RUSH information on Convector Grilles.
☐ Send complete catalog.
☐ Send literature on above checked items.

NAME______________________________

ADDRESS____________________________

CITY____________________STATE________

J-C representatives serve you



ACROSS THE NATION
SEATTLE
ST. PAUL
BELLAIRE
MILWAUKEE
SAGINAW
LYNN
FLINT
CLEVELAND
NEW YORK
AURORA
CINCINNATI
GAITHERSBURG
DENVER
ST. LOUIS
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with America's largest and most complete warm air heating line, from 3,800,000 down to 50,000 Btu output

Supplementing Jackson & Church's extensive plant facilities is a network of factory representatives trained to supply you with the answers to your heavy-duty heating and industrial ventilation problems.

Our Engineering Department at Saginaw, backs these representatives to assist with your heating plans for industrial, commercial or residential installations.

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JACKSON & CHURCH COMPANY, SAGINAW, MICHIGAN
WORK WELL DONE SINCE '81

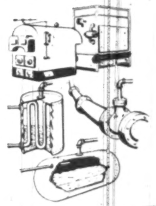
You're ahead 4 ways when you

SELL SERVEL

AIR CONDITIONING EQUIPMENT

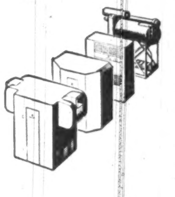
EXCLUSIVE ADVANTAGES OF SERVEL "ALL-YEAR" AIR CONDITIONING OPEN NEW SALES POSSIBILITIES . . . NEW TOP-PROFIT INSTALLATIONS TO YOU!

1 Servel offers the widest choice of energy source



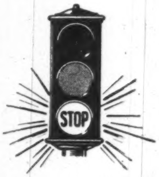
With the addition of oil-fired units, Servel now has a line of air conditioning units that enable you to sell your prospect an air conditioner that uses the most economical energy source available. Only Servel provides you with air conditioning units that operate on gas, oil, LP gas, waste heat or steam from any source, any pressure.

2 Full range of models to fit your entire market



The full range of Servel air conditioning equipment enables you to sell every prospect from the residential and small commercial buyers to the large commercial, industrial and military type installations. The 25-ton Water Chiller especially opens up new sales opportunities in the industrial and military field where large equipment is needed for cooling and process work.

3 Servel "no moving parts" design cuts maintenance cost



Operating on the famous absorption principle, Servel units require no moving parts in their cooling systems. They deliver quiet, continuous, vibrationless operation at peak performance . . . year after year . . . and, because there is nothing in their cooling systems to wear out, require a minimum of maintenance!

4 Servels have a five year factory warranty

Warranty
SERVEL All-Year AIR CONDITIONING EQUIPMENT
SERVEL, INC.
EVANSVILLE 20, INDIANA

The perfected Servel absorption refrigeration unit is warranted for five full years! Five times as long as all other air conditioning units having comparable capacity.

Servel air conditioning offers low operating costs, proven dependability, vibrationless operation—and an exclusive 5-year warranty.

SELL SERVEL . . . the air conditioning that offers low operating costs, guaranteed dependability in home, commercial or industrial installations.

RESIDENTIAL COMMERCIAL INDUSTRIAL

Servel

AIR CONDITIONING

Made by the makers of the famous Servel Refrigerator

SERVEL, INC. • Evansville 20, Indiana

Get the full profit story today!

Servel, Inc., Dept. HPAC-3, Evansville 20, Indiana

Gentlemen:

I'm interested in making more money selling Servel Air Conditioning. Rush me additional information on the exclusive Servel sales and profit advantages!

*Name*____________________

*Firm*____________________

*Address*____________________

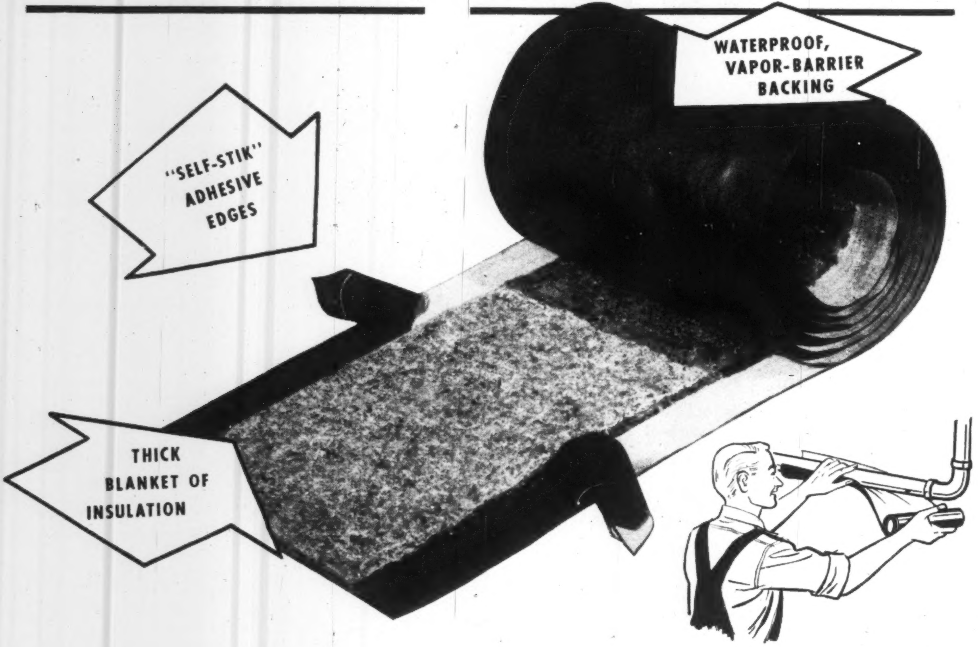
*City*__________ *Zone*_____ *State*_____

MYSTIK

Self-Stik

DRI-PIPE INSULATION

Holds Cold and Heat • Prevents Condensation


WATERPROOF, VAPOR-BARRIER BACKING
"SELF-STIK" ADHESIVE EDGES
THICK BLANKET OF INSULATION

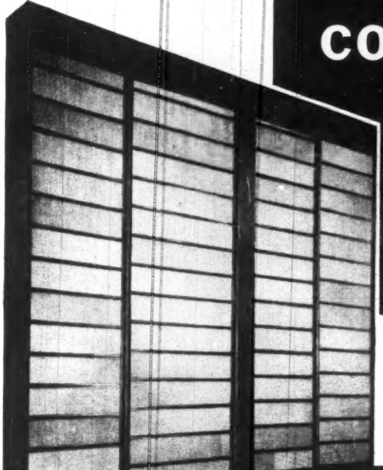
MYSTIK DRI-PIPE—the insulation with "self-stik" edges—goes on fast, saves time and money on installation. Ideal for low-temperature applications—on cold water lines, cold air ducts, refrigeration lines. Holds temperatures, prevents condensation and dripping, eliminates icing and frosting on refrigeration lines. Also has extensive other cost-cutting insulation uses—on warm water lines, warm air ducts and for sound deadening. Ask your supplier or . . .

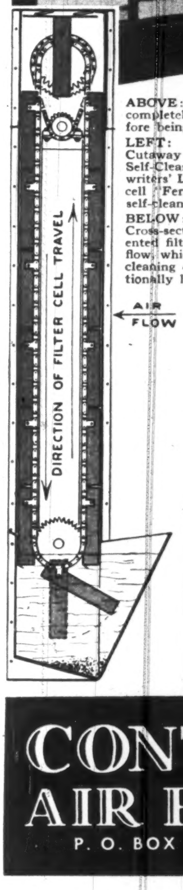
WRITE NOW for free sample of MYSTIK Self-Stik DRI-PIPE Insulation
to Mystik Adhesive Products, 2653 N. Kildare, Chicago 39, Ill.

MYSTIK CLOTH TAPES • MYSTIK PAPER MASKING TAPES • MYSTIK SPRA-MASK • MYSTIK PROTECTO-MASK • MYSTIK SAND-BLAST

WHY CONTINENTALS PROVIDE *unexcelled* AIR FILTERING!

CONTINENTAL



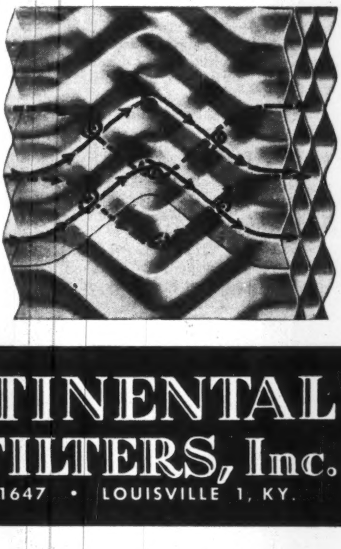


ABOVE: Each Continental Automatic is completely assembled and operated before being shipped.
LEFT:
Cutaway view of Continental Automatic Self-Cleaning filter unit (listed by Underwriters' Laboratories, Inc.) showing filter cell "Ferris Wheel" rotating action and self-cleaning oil bath action.
BELOW:
Cross-section diagram of Continental patented filter media showing turbulent air flow, which results in extremely high air-cleaning efficiency and continuous exceptionally low resistance.

In addition to being excellently engineered and built, the new Continental Automatic Self-cleaning Air Filter has three exclusive advantages. These three exclusive advantages have made it possible, in tests and actual installations, to increase air filtering efficiency, or lower operation cost, or both. These Continental exclusive features . . . which provide unexcelled air filtering performance . . . are:

NEW-TYPE, PATENTED AIR FILTER MEDIA. Has honeycomb openings with large, non-clogging air passages (see sectional drawing). Result: a record of unsurpassed efficiency.

FERRIS WHEEL ACTION OF FILTER CELLS. Moving up and across top of filter, cells are free to rotate around an axis like the cars on a ferris wheel (see cutaway drawing). As cells, retaining their vertical position, pass from front to back curtain, there is *no reversal of air flow through the filter media.* Result: dirt is *not* blown back into the clean-air stream.



POSITIVE SELF-CLEANING ACTION. As each cell moves down into the cleaning oil, it is stopped and held in a semi-horizontal position (see cutaway drawing) until the accumulated dust is soaked loose. The cell then drops into a vertical position—which causes a surge of oil to pass through the filter media, counter-air flow. Result: a *thoroughly* cleaned filter.

Before you specify or buy, ask us for complete details . . including performance data . . on the new Continental Automatic Self-cleaning Air Filters. Use the coupon below. No obligation.

GENTLEMEN: Please send the following:
☐ Bulletin No. 201-C
☐ Sample of Ezwash Air Filter Media

NAME ____________________
FIRM ____________________
STREET ____________________
CITY ____________________ STATE ____________

CONTINENTAL
AIR FILTERS, Inc.
P. O. BOX 1647 • LOUISVILLE 1, KY.

It MUSTN'T Happen Here!
CLOSED FOR LACK OF SCRAP

. . . YET SCRAP INVENTORIES ARE ALARMINGLY LOW. *YOU* ARE BEING COUNTED ON TO HELP KEEP THE FURNACES WORKING . . . TO AID DEFENSE

With our increased steel production, the furnaces are gobbling up an enormous amount of iron and steel scrap.

More—far more—scrap than is at present going into their scrap stockpiles.

Many mills are operating on a hand-to-mouth basis. Some are already threatened with shutdown—for lack of scrap.

The Danger Is Increasing

Will efforts to fill the tremendous demands for steel fail because of lack of scrap?

Steel is made from 50% scrap. We could be severely handicapped—in our aim to keep abreast of both military and civilian requirements—if scrap suppliers can't keep pace with productive capacity.

But they *can* keep pace . . . with your help!

Enough Scrap IS Available!

Yes—the only problem is to get the available extra scrap from where it is—to where it's needed.

Where is it?

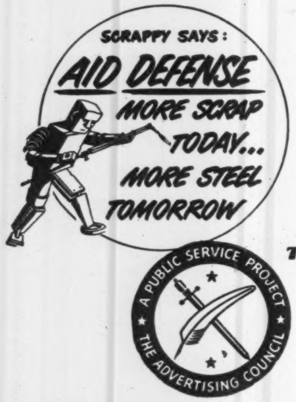
In *your* business . . . in the form of old machines and equipment, tools, implements, dies, jigs, fixtures, outmoded structures, chains, valves, wheels, pulleys—any old iron and steel that's rusting away.

Six Million EXTRA Tons Needed!

By the end of 1952, we'll be producing steel at an annual rate of 20 million tons more than in 1950. That means we will need at least 6 million more tons of scrap than we've ever needed before.

It's up to you. Write at once to Advertising Council, 25 W 45 St., New York 19, N. Y., for a free copy of "Top Management: Your Program For Emergency Scrap Recovery".

Please write today—there's not a day to lose.

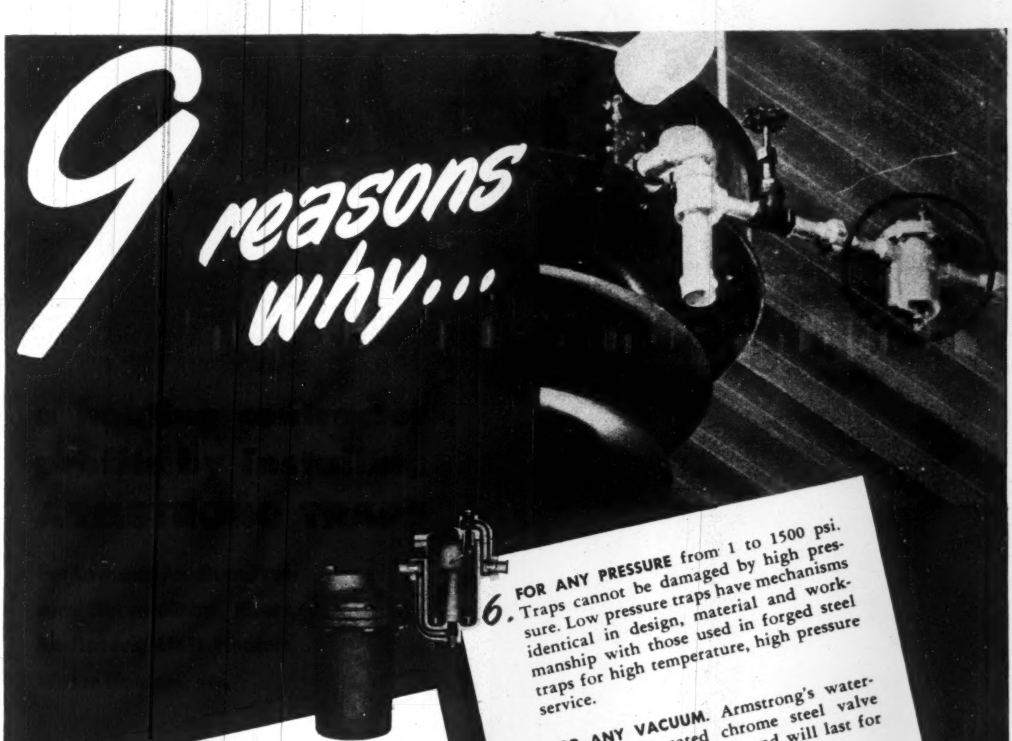


NON-FERROUS SCRAP IS NEEDED, TOO!

This advertisement is a contribution, in the national interest, by

A PUBLIC SERVICE PROJECT
THE ADVERTISING COUNCIL

Heating, Piping and Air Conditioning



9 reasons why...

1. **MORE ACTUAL CAPACITY PER DOLLAR** due to Armstrong's unique free floating lever mechanism.

2. **NO GAMBLE IN SELECTING TRAPS** because Armstrong capacity ratings are actual trap tests with hot condensate instead of slide rule calculations, cold water, or orifice tests.

3. **MINIMUM INSTALLATION COST.** Choice of horizontal or vertical traps reduces fittings and installation labor.

4. **BIG AIR VENTING CAPACITY.** Armstrong Traps are non airbinding. For quick heating use Armstrong BLAST Traps. Auxiliary air reliefs seldom needed.

5. **STRAINERS SELDOM REQUIRED.** Ordinary sediment and sludge are discharged along with condensate. You can guarantee 99 out of 100 Armstrong Trap installations without strainers.

6. **FOR ANY PRESSURE** from 1 to 1500 psi. Traps cannot be damaged by high pressure. Low pressure traps have mechanisms identical in design, material and workmanship with those used in forged steel traps for high temperature, high pressure service.

7. **FOR ANY VACUUM.** Armstrong's water-sealed, heat-treated chrome steel valve parts do not leak steam and will last for years.

8. **ELIMINATE CALL BACKS.** Very seldom does an Armstrong Trap require servicing by the contractor. No adjustments, and no close clearances to require breaking in.

9. **UNQUALIFIED GUARANTEE.** Not for one year, not for two years, but for life are Armstrong Traps guaranteed against defects in workmanship or material.

SEE OUR CATALOG IN SWEET'S

TWO VALUABLE HANDBOOKS

1. The Steam Trap Book — 36 pages of data on selection, installation and maintenance of Armstrong Steam Traps for ALL services.

2. "How To Select Steam Traps for Draining Unit Heaters" — 8 pages of data including BTU capacities of unit heaters made by 24 different manufacturers, how to select traps for each, conversion tables, installation diagrams and other information not available from ANY other single source. Anyone is welcome to a copy of both books. A post card request will do.

ARMSTRONG MACHINE WORKS, 874 Maple St., Three Rivers, Mich.

ARMSTRONG STEAM TRAP "INVERTED BUCKET"

ARMSTRONG STEAM TRAPS

Over a Million in Use... For Power... Process... Heating

You've got a Winning Combination

A ♠ STANDARD ISA FACE-TO-FACE DIMENSIONS
K ♠ "FLOW-LINE" CONTOURED BODY
Q ♠ STELLITED SEATING SURFACES
J ♠ RENEWABLE SELF-ALIGNING GUIDES
10 ♠ SEAT RINGS EASILY REPLACED WITH VALVE IN PIPE LINE

with the New

TRADE
LESLIE
MARK

DOUBLE SEATED DIAPHRAGM CONTROL VALVES

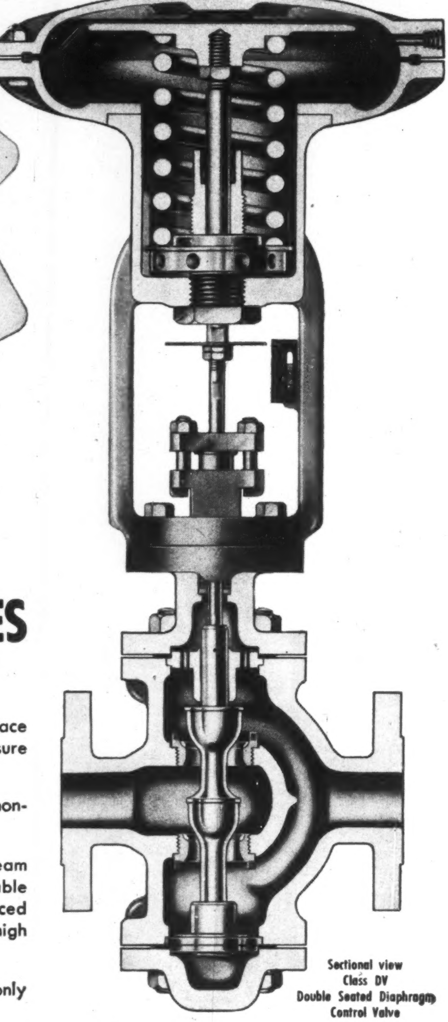
Calling a spade a spade you've got a "royal flush" of features in these new Valves designed for use with control instruments.

Their "Flow-Line" Contoured Bodies have ISA standard face-to-face dimensions and high capacity, low turbulence and minimum body pressure drop characteristics.

A new type, top and bottom guided construction is self-aligning and non-binding regardless of uneveness of bolt tightening.

Standard, integral stellited seating surfaces are recommended for steam service to reduce seat ring thread corrosion. Renewable, interchangeable seat rings also furnished where desired and may be easily replaced without removing valve body from the line. Elaborate grinding at high temperatures is completely eliminated.

With these Valves, you get as *standard equipment*, features heretofore only obtainable in expensive, specially designed valves.



Sectional view
Class DV
Double Seated Diaphragm
Control Valve

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

Albany, N. Y.
Albuquerque, N. M.
Atlanta, Ga.
Baltimore, Md.
Beaumont, Tex.
Birmingham, Ala.
Boston, Mass.
Bridgeport, Conn.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Texas
Denver, Colo.
Des Moines, Ia.
Detroit, Mich.
El Paso, Tex.
Galveston, Tex.
Greenville, S. C.
Houston, Texas
Indianapolis, Ind.
Kansas City, Mo.
Kingsport, Tenn.
Los Angeles, Calif.
Louisville, Ky.
Memphis, Tenn.
Miami Springs, Fla.
Milwaukee, Wis.
Minneapolis, Minn.
Mobile, Ala.
Monroe, La.
New Orleans, La.
New York, N. Y.
Orlando, Fla.
Philadelphia, Pa.
Pittsburgh, Pa.
Ponca City, Okla.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
Rutherford, N. J.
Salt Lake City, Utah
San Francisco, Calif.
Seattle, Wash.
St. Louis, Mo.
Syracuse, N. Y.
Tucson, Ariz.
Wilkes-Barre, Pa.
Wilmington, Calif.
Youngstown, Ohio

Bruxelles-Forest, Belgium

Montreal, Que., Can. • Ottawa, Ont., Can. • Toronto, Ont., Can. • Vancouver, B. C., Can. • Welland, Ont., Can.

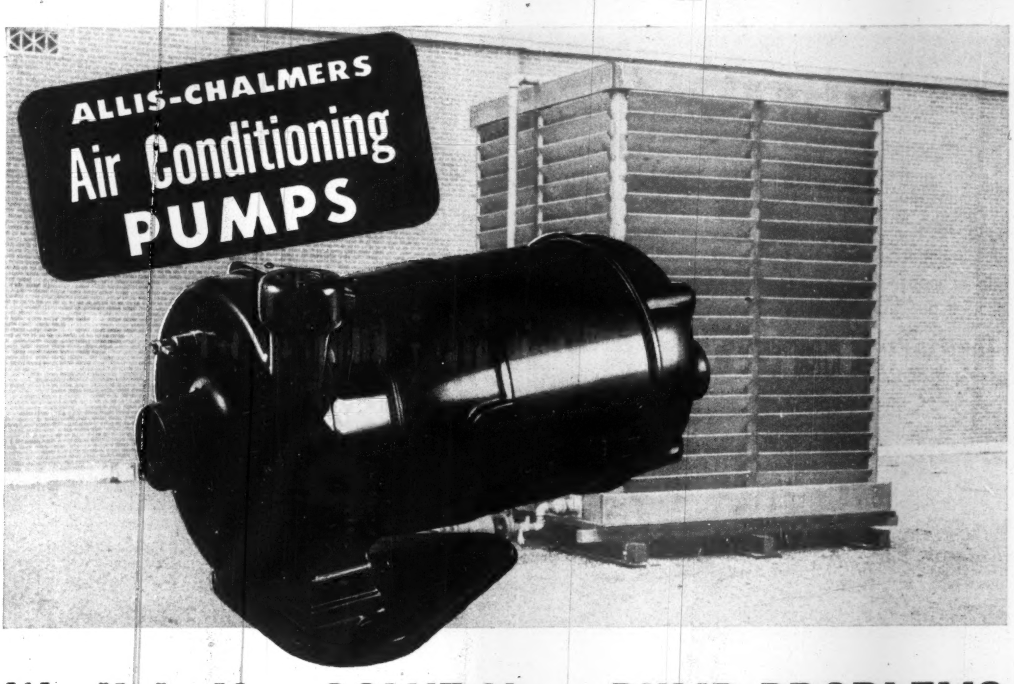
***WRITE FOR* Bulletin 513**

ESTABLISHED 1900
LESLIE
CO.

5707

237 Grant Avenue, Lyndhurst, New Jersey

PRESSURE REDUCING VALVES • • PRESSURE CONTROLLERS
FLOATLESS LEVEL CONTROLS • PUMP GOVERNORS • TEMPERATURE REGULATORS
SELF CLEANING STRAINERS • AIR HORNS • STEAM WHISTLES



ALLIS-CHALMERS Air Conditioning PUMPS

We Help You SOLVE Your PUMP PROBLEMS

ONE OF THE BIG PROBLEMS in air conditioning work is engineering the circulating system. Even though you may know how to do it, it's a place where Allis-Chalmers engineers can save you time and effort.

They will help you work out problems like these:

- **How big a pipe will I need?**
- **How big a pump will I need?**
- **Where's the best place for the pump?**

All in all, you are assured of a perfectly engineered job! As for the installation itself, that is the simplest part of an air conditioning job when Allis-Chalmers circulating pumps are used. All it takes is three mounting bolts, a few pipe fittings, two wires and the silent, smooth-running pump is installed. No maintenance problems either!

Try Allis-Chalmers on your next job. You'll find the pumps can't be beat; prices are in line; and service is fast and good. Call your nearby Allis-Chalmers district office, or write, Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3572

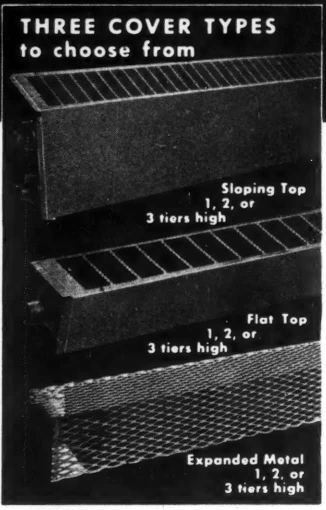
5 FEATURES

of Allis-Chalmers Package Pumps

1. **Standard Motor** — These fractional horsepower pumps are built with NEMA standard motors of a well-known brand. Built-in thermal protection provided.
2. **Mechanical Seal** is used rather than the usual packing gland. Mechanical seal doesn't leak and requires no regular maintenance.
3. **Closed Impeller** is accurately die cast of special bronze. Impeller has smooth surface and high hydraulic efficiency. It is carefully machined and balanced for quiet operation. Impeller can easily be removed with screwdriver and Allen-type wrench.
4. **Rotatable Casing** — Discharge may be placed in any of four directions.
5. **Easy Installation** — Motor and pump are a single complete unit which is simply bolted in place. No extra parts to buy.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS


THREE COVER TYPES
to choose from
Sloping Top
1, 2, or
3 tiers high
Flat Top
1, 2, or
3 tiers high
Expanded Metal
1, 2, or
3 tiers high

low level cost . . . all level comfort . . . with DUNHAM *FIN-VECTOR* *RADIATION*

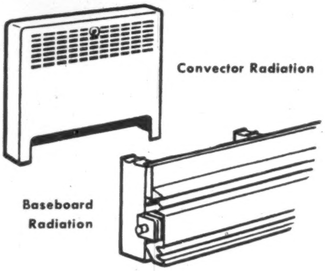
Put Dunham Fin-Vector Radiation near the floor, under windows, or *at any height* along outside walls . . . and you're sure to get the heat you need—for less.

Better Heat Distribution. Materials used are those best suited for rapid heat transfer. Heating elements may be installed one, two, or three tiers high to assure effective heat distribution.

Economical to Install. Light in weight, Fin-Vector requires few supports . . . is easy to handle. Choice of covers and heating elements in numerous sizes and types greatly reduces on-the-job cutting; speeds assembly.

No matter *what* you require in radiation equipment . . . Dunham can help you. In addition to Fin-Vector and space-saving Baseboard Radiation, Dunham offers a complete selection of Convectors—including special institutional types.

For further information on Dunham Fin-Vector Radiation, write for Bulletin 1251-2. Similar literature available on other products.


Convector Radiation
Baseboard
Radiation

C. A. DUNHAM COMPANY

400 West Madison Street, Chicago 6, Illinois
In Canada: C. A. Dunham Co. Ltd., Toronto
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DUNHAM

heating systems and equipment

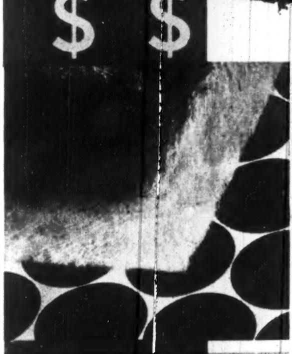
Vari-Vac Differential Heating • Baseboard Radiation
Convector Radiation • Vacuum Pumps • Condensation Pumps • Horizontal and Vertical Discharge Heaters • Traps • Valves

SELL THE PROFIT LINE

3 PRODUCTS—30%-50% MORE PROFIT

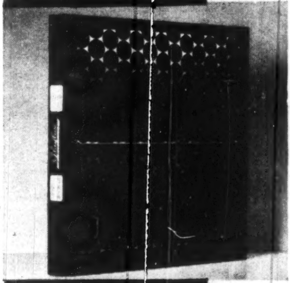
THE ONLY COMPLETE LINE OF GLASS FIBRE AIR FILTERS FOR FORCED AIR HEATING, VENTILATING AND AIR CONDITIONING.

Wherever disposable air filters are used—in homes or industry—the Glasfloss line triples your sales potential at 30-50% greater profit. It pays to sell the best—Sell *Glasfloss*.



1 *Glasfloss* **THE I-S TYPE**

For peak air filtering efficiency, the GLASFLOSS I-S Air Filter is the answer. A strainer mat has been added to the famous long, glass fibres that make up the standard GLASFLOSS Air Filter pad. The combination of two filters in one brings air filtering efficiency to as high as 95%. No other air filter on the market can compare. Figured on Peak Efficiency you win with Glasfloss.



2 *Glasfloss* **STANDARD TYPE**

This is the conventional type—the filter most in demand. The long, fine glass fibres provide a greater surface area to catch and hold more dust with less air resistance. The Glasfloss STANDARD Filter is for home heating, air conditioning equipment and normal industrial installations. Available in all standard sizes. Competitively priced to beat the field.

3 *Glasfloss* **ROLL-PAK TYPE**

Here is a product carefully planned for bulk users. Cut your own filter pads—fit them into your own frames and save as much as 30% of your normal air filter costs. Available in rolls, 40″ wide and 10′ long and 1″ and 2″ thickness. Application is easy. Just roll it out, cut to size and put into position. The fluffy, fine fibres are easy on the hands. For Economy in bulk usage it's Glasfloss all the way.

For Complete details on any product in the GLASFLOSS Line, write Dept. HPAC-1

Glasfloss 155 EAST 44th STREET, NEW YORK 17, N. Y.

HIGH SPEEDS
NO PULSATION
QUIETNESS
RELIABILITY
ACCESSIBILITY
Add it all up and you have—
IMO

A BETTER PUMP FOR OIL BURNERS

There's no other pump quite so satisfactory as the IMO for oil burner service because there is no other pump built just like the IMO — the only positive displacement, rotary pump with no vanes, valves or pilot gears.

The IMO can be direct-connected to high speed motors or turbines; it requires no reduction gearing; occupies but little space; and operates smoothly, quietly and efficiently.

For your next oil burner job be sure of the best . . . specify the new low cost IMO A313A.

Bulletin on request.

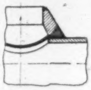
DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

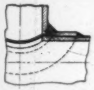
Here's another reason why the 'Specs' call for "WELDOLETS"

Extra strong WeldOlets, butt-welding, utilized to make fully reinforced branch connections in Gas Measurement Header [illegible]

LET'S COMPARE THE PLUS FEATURES OF WELDOLETS AGAINST REINFORCING RINGS OR PADS



1. The WeldOlet is a Welding Fitting rather than a hand-made reinforcement of a hand-made joint. It is both a mechanical and a pressure member.
2. The self-aligning, shaped and beveled WeldOlet is equally adaptable for shop or field fabrication. Its employment eliminates the need for additional reinforcement.
3. Production economy is realized by employment of WeldOlet construction which speeds up installation time in both shop and field fabrication. Only two welds are required to install WeldOlets.
4. The WeldOlet type of construction inherently provides sufficient reinforcement in accordance with Code requirements to meet or surpass the maximum services of whatever weight pipe is used. To facilitate determination of where it is necessary to reinforce or to use a WeldOlet, the new Bonney catalog W-3 features time-saving data on this subject.
5. Dimensional advantages of WeldOlets allow closer manifolding and cross combinations and provide improved flow conditions.



1. Precious pipe is wasted in making reinforcing rings or pads.
2. Reinforcing rings can be cumbersome to handle and clumsy to fit in both shop and field fabrication.
3. Excessive welding is necessary to complete branch reinforcing requirements according to Code provisions when rings or pads are used. Three separate welds are required. This slows down piece production time in both shop and field fabrication.
4. Lengthy calculations are necessary to determine the amount of reinforcing required when designing for ring or pad reinforcement.

The Bonney Catalog No. W-3 will show you why WeldOlet Welding Fittings offer the quickest, safest and most economical method of establishing and maintaining 100% pipe strength at branch connections in accordance with Code provisions. Write for your free copy.

CANADIAN REPRESENTATIVE
Sterling Steel Co., Ltd.
267 Davenport Road
Toronto 1, Canada

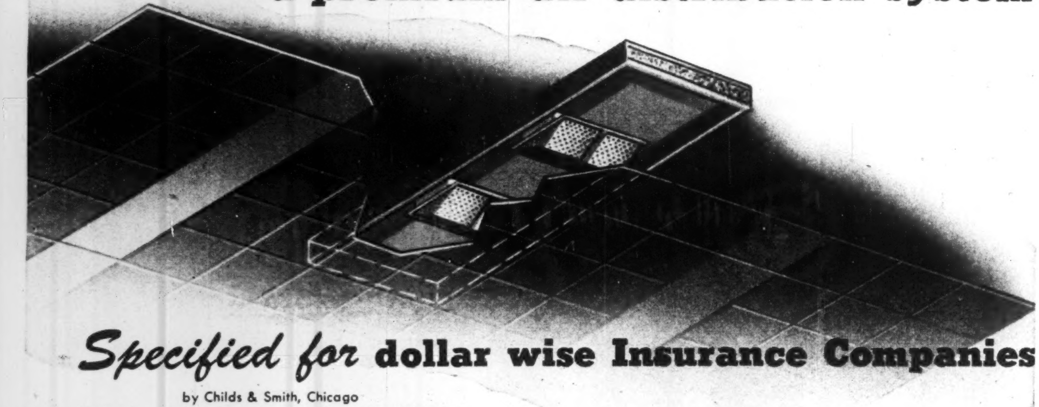
EXPORT DISTRIBUTOR
National Supply Co. Export Div.
600 Fifth Ave., New York 20, N.Y.

BONNEY FORGE & TOOL WORKS

MULTI-VENT *low velocity air diffusion ceiling panels*

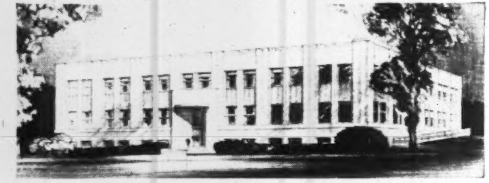
T.M. Reg. U.S. Pat. Off.

a *premium* air distribution system

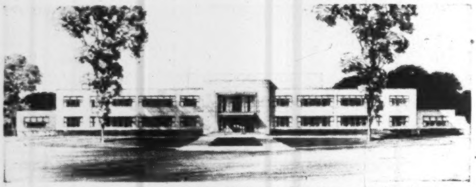


Specified for dollar wise Insurance Companies

by Childs & Smith, Chicago
Architect-engineers for the four new buildings illustrated below



Shelby Mutual Casualty Co., Shelby, Ohio



Farmers Mutual Automobile Insurance Co., Madison, Wisc.

Utica Mutual Insurance Co., Utica, N. Y.

Lumbermans Mutual Insurance Co., Mansfield. Ohio

Comfortable, complaint-free air conditioned office spaces are an important factor in the productivity and employee relations of any company where office work plays an important role. That is why these insurance firms were readily convinced that their dollars were spent *wisely* on Multi-Vent panels for air distribution . . . a premium product which guarantees a superior, faultless performance worthy of their investment in the over all air conditioning system. For with Multi-Vent panels installed throughout, completely concealed in standard acoustical ceilings, a widespread, uniform air distribution is enjoyed free from all the hazards of drafts, noise and dirt. In addition the unique radiant panel heating or cooling effect of the Multi-Vent panel adds to the comfort factor.

Only Multi-Vent distributes air entirely by displacement rather than by high velocity injection. That means there are no strong air streams to aim and no change in air flow pattern when air supply is varied. Even with movable partitions and low ceilings, all problems of outlet location and direction adjustments for throw and drop to avoid drafts are eliminated . . . there simply are no drafts!

The use of Multi-Vent makes possible many sound economies in the basic heating, cooling, and air conditioning equipment in addition to substantial reductions in installation, maintenance, and redecorating costs. It pays to specify the finest in air diffusion systems . . . Multi-Vent. Write now for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.

MULTI-VENT DIVISION

THE PYLE-NATIONAL COMPANY
1373 North Kostner Avenue **Chicago 51, Illinois**

It's Better than ever!

Improved Design

Accepted everywhere for

- **LIQUID LEVEL CONTROL**
- **LIQUID LEVEL INDICATION**
- **INTER FACE CONTROL**

Yes — it's preferred, because it gives peak performance. The newly designed Fisher Series 2500 Level-Trol combines many improved features to better meet every field service requirement — to provide longer life with ease of maintenance. Write today for Fisher Bulletin F-3.

TYPE 2500-259
with fabricated
steel float cage . . .

and the little Brother and Sister

TYPE 2500-249V
for side
vessel mounting

TYPE 2500-249P
for top
vessel mounting

FISHER®

LEVEL-TROL®

FISHER GOVERNOR COMPANY
Marshalltown, Iowa

FISHER®

WORLD LEADER IN THE MANUFACTURE OF LIQUID LEVEL CONTROLLERS, PRESSURE REGULATORS AND IN RESEARCH FOR BETTER CONTROL

THERE'S NO PLACE FOR THESE TROUBLEMAKERS • •

MAINTENANCE
POOR REGULATION
REPLACEMENTS
SPOILAGE
STOPPAGES
FAILURES

IN PLANTS THAT CAN MAKE A STATEMENT LIKE THIS • •

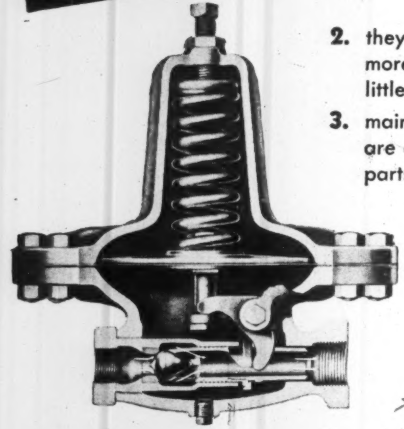
"We use your Streamlined '1000' Valves on the following equipment:

Heating Systems
Solution Heaters
Plating Tanks
Degreasing Machines
Hot Water Heaters

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE

"We use them:

1. because they hold close delivery pressure control.
2. they don't get gummed up, so we get more and better production with very little lost time.
3. maintenance cost is very low—the guts are cheap—old parts come out and new parts go in easily with little time lost."



•

ITS ASPIRATOR AND STREAMLINED FLOW WORK TO YOUR BENEFIT IN THESE 12 WAYS . . .

1. Maximum Capacity when needed most. 2. Accurate Pressure Control under toughest working conditions. 3. Trouble-free Service. 4. Smooth Operation. 5. Tight Closure. 6. Accurate Regulation. 7. Speedier Production Results. 8. Elimination of Failures. 9. Constant Delivery Pressure. 10. Cost Saving Operation. 11. No Spoilage. 12. Practically zero in maintenance costs.

CASH STANDARD
CONTROLS... VALVES

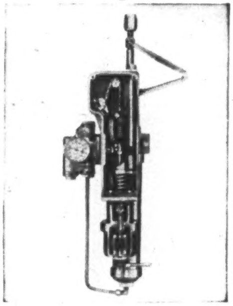
A. W. CASH COMPANY
DECATUR, ILLINOIS

•

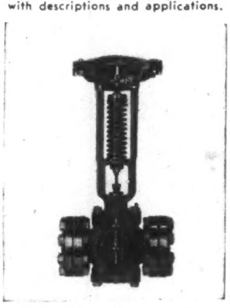
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

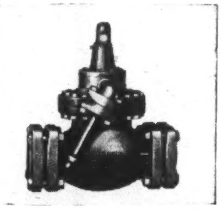
•



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

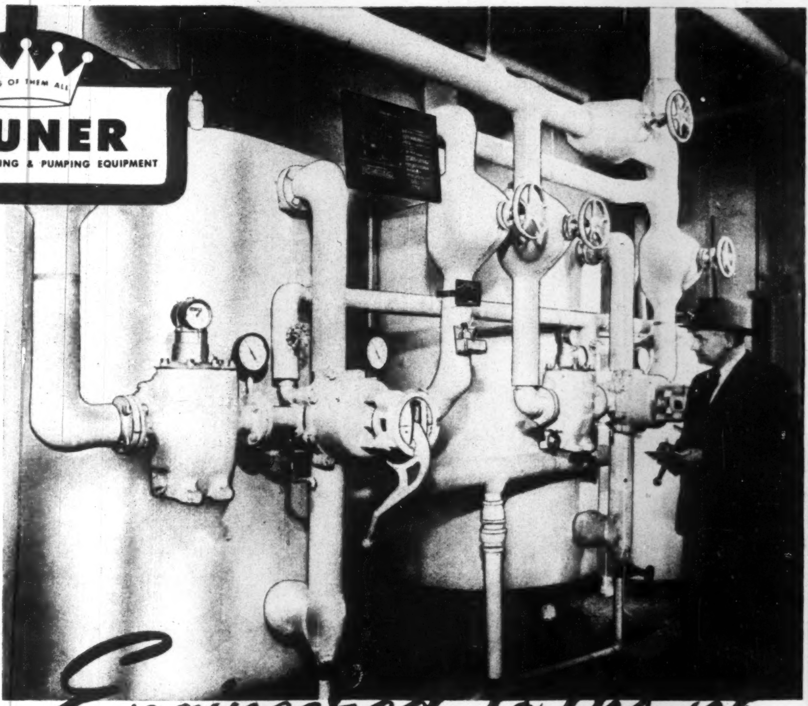


Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

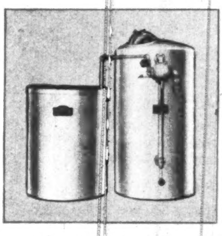
KING OF THEM ALL

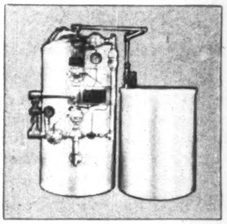
BRUNER

WATER CONDITIONING & PUMPING EQUIPMENT



Engineered to the job





Heavy-duty models — 80 to 160 gpm. 600,000 to 1,200,000 gr. cap. Carried in stock. UPPER LEFT, Solo Valve. UPPER RIGHT, Dial-O-Matic. LOWER RIGHT, Brucex Feeder for corrosion control and prevention of red water.

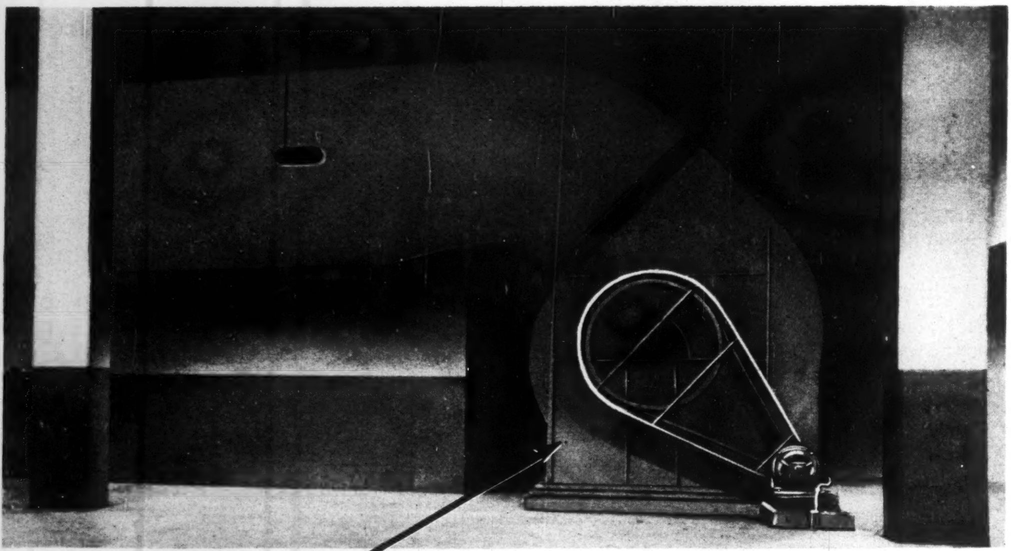
Pictured on the job at the Methodist Hospital of Central Illinois at Peoria, Illinois is a BRUNER Industrial heavy-duty model engineered to produce 70,000 gallons of pure soft water from water of 26 gr. hardness. This installation is another example of BRUNER design and manufacturing craftsmanship that assures absolute satisfaction.

●

It will pay you to get the recommendations of the Bruner Corporation laboratories if you have a problem in the field of water softening, filtering or conditioning. Your inquiry will receive prompt attention. Of course, there is no obligation.

"America's Most Complete Line of Quality Water Softeners and Filters"

[illegible]



The ♥ of Your System –

It's a supply fan, of course. Yet, there's a surprisingly close analogy between mechanical ventilation and blood circulation. Supply ducts are arteries, branches are capillaries, spaces are cells, returns are veins, — we could draw out this parallel, but you'll get the point without further elaboration.

Some analogies may be misleading. But in this case, we're sure you'll agree that whether circulating air or blood, the system functions to best advantage when equipped with a sound heart. If the heart fails, circulation stops, with fatal results.

The heart with which you're born is not one of your personal choice, but you *do* have the choice of one for your ventilating or conditioning system. Certainly you'll want to make the best of this opportunity.

Don't take chances on a weak heart. Choose wisely! Choose Bayley! And finally, — for even longer life, take care of that heart. It's the most vital component in your system.

– performs better, – longer,

if it's Bayley

AIR HANDLING EQUIPMENT

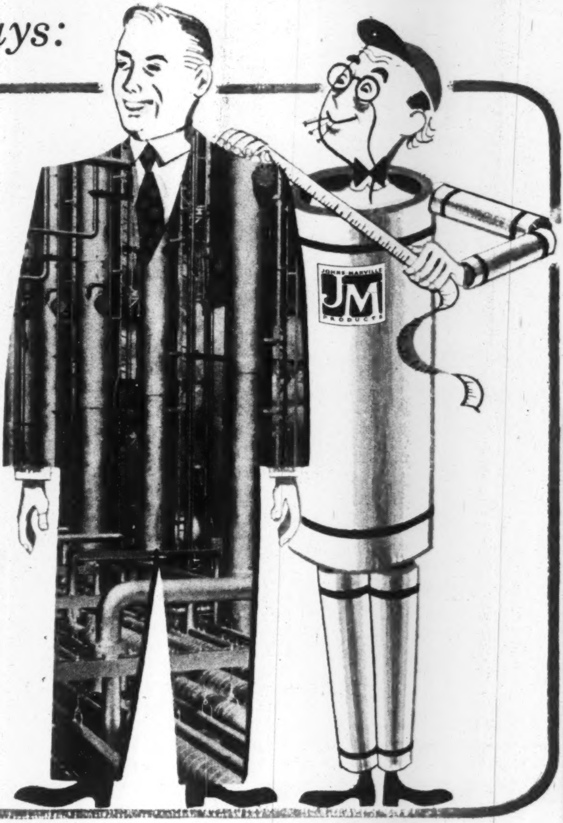
BAYLEY BLOWER COMPANY

6600 W. BURNHAM ST. MILWAUKEE 14, WIS., U. S. A.

Mr. Insulation says:

"Buying insulation is like buying a suit of clothes:

—the better the materials; the more expert the tailoring, the better your investment"



Just as no one cloth can be used for every suit of clothes, there is no one raw material that can serve as the ideal insulator for every industrial insulation job.

For this reason, Johns-Manville manufactures a wide variety of industrial insulations—of asbestos and other raw materials—each of which is designed for a special purpose. These insulations span the entire range of temperatures from 400 F below zero to 3000 F above.

But, again, there is much more to the story of insulations than their manufacture. In order to get the greatest return from your investment in them, they must be expertly engineered to the job, and then skillfully applied.

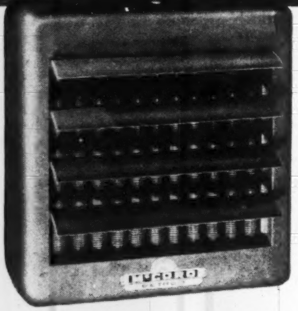
Johns-Manville makes available to you the service of experienced insulation engineers, and highly skilled mechanics for the proper application of Johns-Manville insulations.

If you are contemplating an insulation installation for your plant, it will pay you to look into this Johns-Manville insulation service. For further information just write Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville *first in* **INSULATIONS**

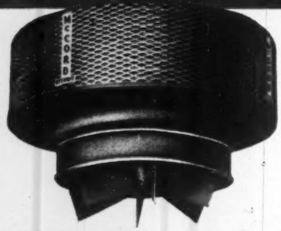
McCORD
HEATING AND
AIR CONDITIONING
PRODUCTS

HORIZONTAL TYPE UNIT HEATERS



Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

VERTICAL TYPE UNIT HEATERS



A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure: Sizes to 575,000 B.T.U. capacity.

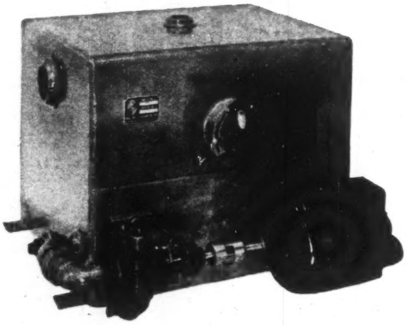
McCORD CORPORATION
DETROIT 11, MICH.

PUMP ?
STUMPED

an

EAGAN
PUMP

is the answer



"Illustrated above is the **Eagan "Eagle"** versatile unit, handling 8,000 sq. ft. at 20 P.S.I. and selling for a trade price of **$139.00** F.O.B. Philadelphia.

Eagan Standard Units are made in single and duplex models to 150,000 sq. ft. E.D.R. at pressures to 200 P.S.I.

Your pump problems are invited. Eagan engineers or your local Eagan representative or the factory engineers offer their services for any pump requirement."

Write Today

WALTER H. EAGAN CO., Inc. (Dept. B)
2336-38 Fairmount Avenue
Philadelphia 30, Pennsylvania

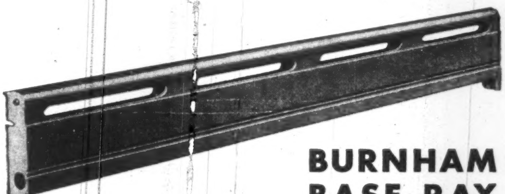
SAVE THAT EXTRA PIPE
—it's almost enough for your next job!

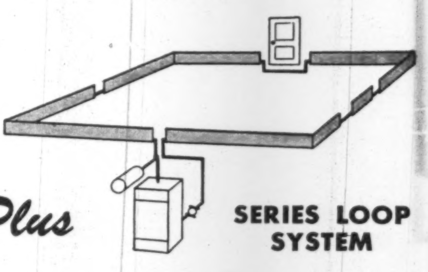
When you can save precious pipe today it's news, and a saving of 40%* is BIG news! Hundreds of Burnham BASE-RAY** Radiant Baseboard installations made with the Series Loop System (see diagram) are what make this big news. Try this hook-up yourself. It will be a surprise for you and for your customers! You'll not only save pipe, but fittings will be *49% less* . . . installation labor *54% less*. And remember... with BASE-RAY you'll be giving your customers the most efficient, space-saving radiant baseboard heating available!

And to assure your customers abundant, low-cost, year 'round domestic hot water, there's nothing like a super-efficient Burnham PACEMAKER *or* YELLO-JACKET *Boiler. Each has built-in copper water heater—tankless or storage type.*

*Compared with conventional one-pipe forced circulation system in a 1-story basementless house. Comparable savings made in other types of houses.

**Reg. U. S. Pat. Off.





BURNHAM BASE-RAY RADIANT BASEBOARD *Plus* **SERIES LOOP SYSTEM**

Women, especially, prefer the low, sweeping lines, and space-saving advantages of BASE-RAY, as well as its clean, even, dust-and-draft-free heat.

The Series Loop System shown here is ideal for ranch type and basementless houses. Can be used with comparable results in 2-story houses with basement. See page 10, IBR Installation Guide No. 5.

BASE-RAY WEARS LIKE IRON . . . FOR IT IS MADE OF IRON

Burnham Corporation

FIRST **IN THE MANUFACTURE OF BASEBOARD HEATING**

BOILER DIVISION . . . IRVINGTON, NEW YORK

BURNHAM CORPORATION, Dept. HP-32
Irvington, N. Y.
Please send me Base-Ray Literature:

☐ New 6 page BASE-RAY folder ☐ BASE-RAY Ratings and Installation Guide

Name ....
Address ....
City ....State ....

76
UNION OIL CO
OF CALIFORNIA
RESEARCH

. . . at its new $5,000,000 oil research center

UNION OIL COMPANY planned for lasting economy . . . installed JENKINS VALVES

Architects
AUSTIN, FIELD & FRY, LOS ANGELES
General Contractors
P. J. WALKER CO., LOS ANGELES
Mechanical Contractors
S. GLEN HICKMAN CO., LOS ANGELES
Consulting Mechanical Engineer
SAMUEL L. KAYE, LOS ANGELES

The new 14-building research center of the Union Oil Company of California is unique in many features of design. Here, a research staff of 250 will have every modern facility for developing products that will shape the company's future progress.

The same future-minded attitude was maintained toward plant operating costs by the architects and engineers who specified equipment. To insure lasting efficiency and maintenance economy, they chose Jenkins Valves for more than 3,000 control points on the miles of steam, water, sanitation, fire-control, and other pipelines essential to operations.

Like so many of the nation's top-flight building specialists, these men have confidence in the *extra measure* of efficiency and endurance built into Jenkins Valves.

Despite this extra value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Avenue, New York 17; Jenkins Bros., Ltd., Montreal.

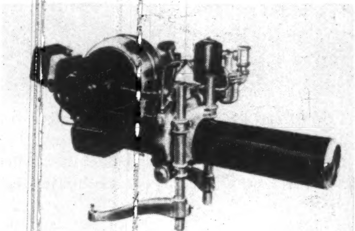
SOME OF THE 3000 JENKINS VALVES installed at the new research center. Many structural innovations, designed to simplify maintenance, are unique in this plant. Tunnels between buildings carry all pipelines; make them readily accessible. Air-conditioning system supplies 100% fresh air to laboratories at all times. The administration building, shown above, is one of 14 major buildings on a 100 acre site.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK
Jenkins Bros

EQUIPMENT DEVELOPMENTS...

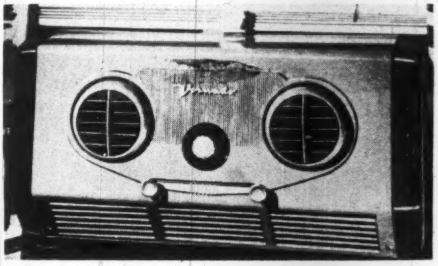
Combination Gas and Oil Burner

HPAC 1**—"Syncro-Flame" combination oil and gas burner which switches from one fuel to the other either automatically or manually — Synchronous Flame, Inc., 327 S. La Salle St., Chicago. It is available in four sizes with capacities of from 100,000 to 1,350,000 Btu per hr. for various commercial and light industrial applications. The burner has automatic electronic ignition, electronic safety controls, and a flame adjustable for either gas or oil. It burns natural, manufactured, mixed or LP gas, and from No. 1 to No. 3 oil. It was developed by Wisconsin Southern Gas Co. engineers.



Window Type Room Conditioner

HPAC 2*—¾ ton "Vornado" room air conditioner (window type) for cooling, circulating, dehumidifying, exhausting, filtering and ventilating the air — The O. A. Sutton Corp., 1812 W. 2nd St., Wichita 1. It is planned that the line will also include, 1/3, ½, 1 and 1½ ton models. The unit incorporates twin air directors which permit flow of air to different parts of a room at the same time, with a velocity that gives penetration up to 30 ft into the room, the manufacturer states. A pressurized exhaust system permits reduction of the cooling capacity from 8800 to 7700 Btu per hr. (When the exhaust damper is opened, air is picked up in front of the twin blower discharge, exhausting a portion of the air being moved and reducing the amount of air through the cooling coils). The Btu reduction increases moisture removal capacity proportionately. The conditioner is designed to remove air at 200 cfm, and it exhausts without the compressor running. It operates on either 110 or 230 volt current.



Heating Systems for Railroad Cars

HPAC 3—Automatic railroad car heating systems for coaches, sleeping room cars, and other types, designed to afford a low cost means of modernizing older cars.—Vapor Heating Corp., 4501 W. 16th St., Chicago 23.

In the "Unizone" system for coaches, steam from the generator in the diesel locomotive is the heat source. Steam from the trainline under the coach is directed to one or two automatic steam regulators (illustrated) under the car, which are electrically opened and closed by one thermostat in the coach. This feeds the right amount of steam to the floor radiators and overhead radiator to keep the car at 75 F. Hot wash water for the car is heated by steam from a special flow valve in the steam regulator, steam being continuously supplied to the hot water heat exchanger, even when not needed to heat the car.

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1952 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [3-52]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35										
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115
116	117	118	119	120	121	122	123	124	125	126	127		129	130
131	132	133	134	135	136	137	138	139	140	141	142	143	144	145
146	147	148	149	150	151	152	153	154	155	156	157	158		

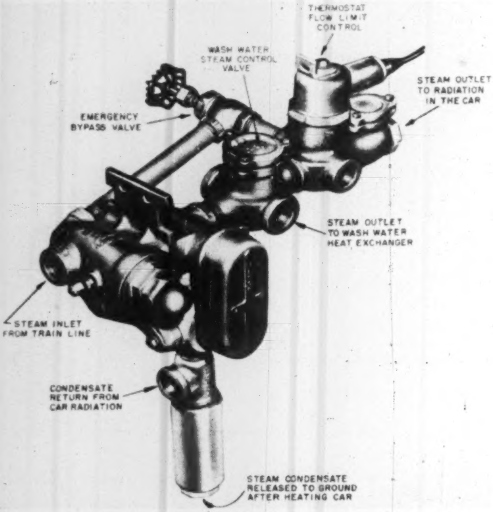
Name ______________________ **Title** ______________

Company ______________________________________

Address ______________________________________

City ______________ **Zone** ________ **State** ______________

In the "Moduzone" system for room cars, a remote control, set by the passenger, adjusts the steam valve orifice on the radiator. The room cars have three steam regulators and two master thermostats. One master thermostat, connected to the two skin pickup thermostats, controls steam flow through the regulators on each side of the car that admit steam to the unit fin radiation in rooms and passageway. The skin thermostats, installed on the inside of the outer skin of the car, one on each side, compensate for the sun's heat. Another thermostat in the overhead air duct controls the steam regulator allowing steam to the overhead radiator which keeps the car comfortable on mild days. In these systems, where possible, car heat pipes are insulated with the trainline steam pipe to save heat.


THERMOSTAT FLOW LIMIT CONTROL
WASH WATER STEAM CONTROL VALVE
STEAM OUTLET TO RADIATION IN THE CAR
EMERGENCY BYPASS VALVE
STEAM OUTLET TO WASH WATER HEAT EXCHANGER
STEAM INLET FROM TRAIN LINE
CONDENSATE RETURN FROM CAR RADIATION
STEAM CONDENSATE RELEASED TO GROUND AFTER HEATING CAR

The new "Aquazone" heating system, for various types of cars, such as electrified trains, uses liquid (water or a non-freezing solution) as the heating medium. It is circulated by an electric pump through the floor and overhead radiators, and may be heated by trainline steam, by waste heat from diesel motors in the cars, or by a small, automatic hot water heater using oil or propane fuel. This system is also thermostatically controlled.

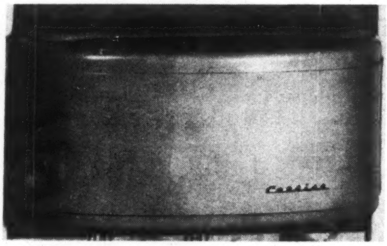
The company's "Unit Fin" radiation has one pipe inside another; steam enters the inner pipe, goes to the end of the radiation, then to the outer pipe. The steam condenses and the hot condensate in the outer pipe gives off heat. The company has designed adapter fittings that can be installed in copper or steel finned single tube radiation while a car is being modernized.

Plastic Tubing

HPAC 4—**Plastic tubing for use in fluid, gas or low volume pressure systems — Hudson Industries, Inc., 4400 St. Aubin Ave., Detroit 7. According to the manufacturer, the tubing will not harden with age, dry out, become brittle or crack; it has no moisture absorption, and maintains a tensile strength of 600 lb per sq in. at a room temperature of 70 F. Melting point is 250 F. The company has designed a series of fittings for use with the tubing.

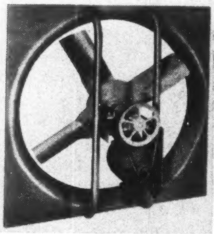
Window Type Air Conditioner

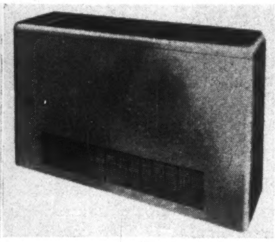
HPAC 5—1/3 hp window sill room air conditioner for small offices and similar applications — Carrier Corp., 302 S. Geddes St., Syracuse 1. Similar in all respects to the ½ and 1½ hp models, it is also being produced in a newly developed pearlescent finish. Window mountings are equipped with a new weatherproofing seal. Fingertip controls can be set for cooling and dehumidification with either outside or room air, or for ventilation only, with filtered outside air.



Panel Vent Set

HPAC 6—Panel vent set for use at free delivery or relatively low static pressure — DeBothezat Fans Div., American Machine and Metals, Inc., East Moline, Ill. Units are available with fan wheels 24, 30 and 36 in. in diameter, with air moving capacities up to 13,190 cfm. The totally enclosed ball bearing motors are wound for dual voltage.


Panel Vent Set


Heater

Unit Heaters

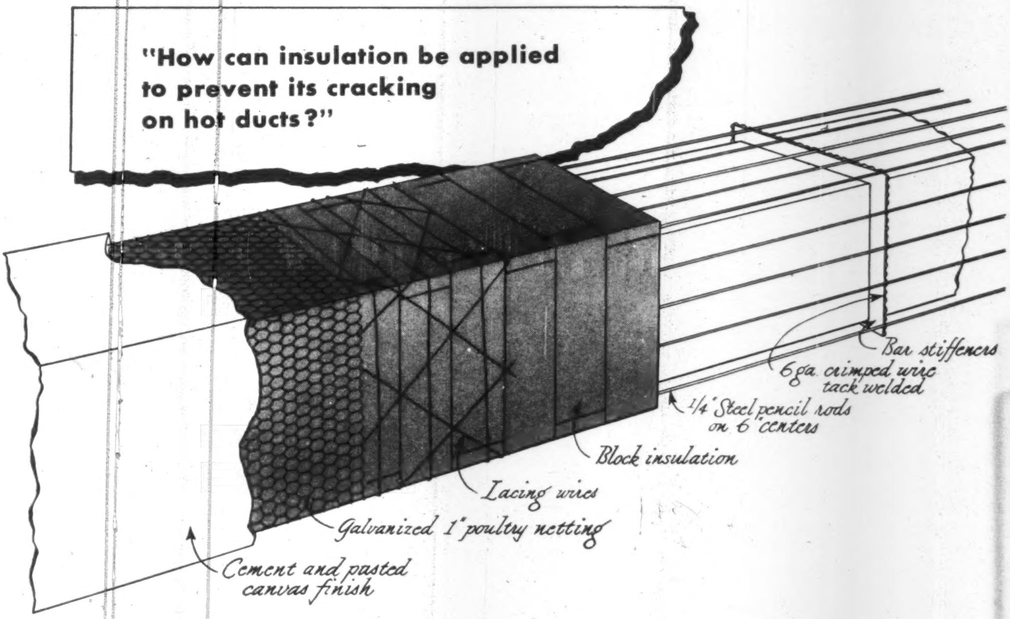
HPAC 7—"Force-Flo" heaters in three new models — a freestanding unit, a semi-recessed design, and a completely recessed cabinet — The Trane Co., La Crosse, Wis. Designed for use in lobbies, showrooms, schoolrooms, churches, etc., they have front inlet and outlet grilles for blanketing doorways or other areas where air must be discharged horizontally from the unit. The cabinet front is removed by loosening two cam locks, and a new headering system permits concealed piping in any position, including ceiling mounting. All units can be installed in either steam or hot water systems, with capacities up to 105,000 Btu.

Humidity Control

HPAC 8—Model H 64A humidity control designed for manufacturers of portable and packaged humidifying and dehumidifying systems, and for other applications requiring a low cost humidity controlling device — Minneapolis-Honeywell Regulator Co., 2641 4th Ave., S., Minneapolis. When tested in a special chamber (air moving at

We have been asked:

"How can insulation be applied to prevent its cracking on hot ducts?"


Bar stiffeners
6 ga. crimped wire tack welded
1/4" Steel pencil rods on 6" centers
Block insulation
Lacing wires
Galvanized 1" poultry netting
Cement and pasted canvas finish

A plant engineer wrote to us recently and outlined this problem — "We plan to insulate a metal breeching which operates at a temperature of 400° F. How should the insulation be applied to prevent its cracking due to the expansion and contraction of the duct underneath?"

In answering this question, we made the following recommendation: We suggest insulating this duct with blocks of Armstrong's 85% Magnesia, 3" thick. Its top temperature limit of 600° F. allows a safety margin of 200° in this application. The blocks are applied as shown in the drawing above. First, the stiffeners are bridged with 1/4" steel pencil rods on 6" centers. End joints should be staggered at least 18" apart, with all butting ends tack welded. The rods are held in place with 6-gauge crimped wire, tack welded to the stiffeners on approximately 6" centers. Care should be taken, however, to prevent the rods from being welded to the stiffeners.

Next, the blocks of 85% Magnesia are applied at right angles to the rods. They are held in place with black annealed wire laced around the rod and the block. 1" galvanized poultry netting is then stretched over the insulation and tied tightly to each intersection of lacing wire.

A rough coat of cement is then applied, thick enough to cover the wire mesh. This is followed with a finish coat of cement troweled smooth.

An 8-ounce canvas jacket, neatly pasted on, completes the job. If an expansion joint is used, it should be insulated separately, in the same manner as the duct.

Helping you find the right answers to your insulating problems is only a part of Armstrong's Insulating Service. We can take over the entire job for you—furnish top-quality materials plus skilled mechanics to apply them properly—and eliminate the costly failures that so often result from lack of knowledge or poor workmanship. Next time you're faced with any insulation problem, contact your near-by Armstrong representative. He will be glad to show you how you can take full advantage of Armstrong's *complete* insulation service — and be *sure* of a thoroughly professional job.

SEND US YOUR QUESTIONS: If you have any questions on insulating materials or their use in high- or low-temperature installations, please write us. We'll see that you get a prompt, practical answer. Just address your letter or post card to Armstrong Cork Company, 4403 Maple Street, Lancaster, Pennsylvania.

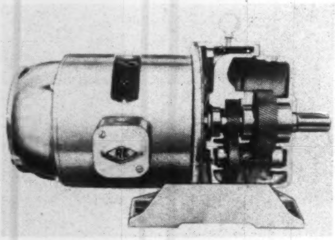
ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

1200 fpm. and rate of humidity change 1 percent per min) the control had an operating differential of less than 5 percent, the company states.

Control

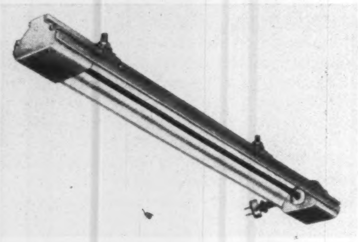

Gear Reducer

Gear Reducer with Internal Fluid Coupling

HPAC 9—Unit consisting of a standard fluid shaft motor and gear train, designed to convert the motor's conventional high speed into a slow speed, high torque output — Reuland Electric Co., 3001 W. Mission Rd., Alhambra, Calif. The integral fluid coupling provides cushioned starting of heavy loads and protection against "jamming" of equipment, the manufacturer states. Applications include dryers, mixers, etc. Power-take-off shaft, gears and bearings are located adjacent to the vertical centerline of the pyramidal base, load pull being transmitted direct to the base.

Portable Electric Radiant Heater

HPAC 10—"Chromalox" all-metal, portable radiant heaters for warming workers in hard-to-heat locations, both indoors and out — E. L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8. Standard units are equipped with a 6 in. length of BX cable and plug, and two movable mounting clamps and bolts. Heaters can be bolted alongside of machines, mounted on portable rigs, etc. Three models are available: 24½ in. long, 800 watts; 30 ¾ in. long, 110 watts; and 46¾ in. long, 1800 watts. The first two are available for 115 or 230 volts, the last, 230 volts only.

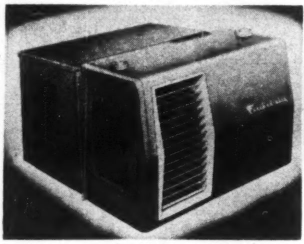


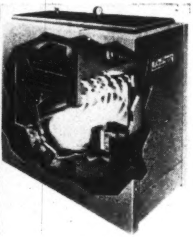
Cement for Protecting Outdoor Heat-Insulated Pipe Lines

HPAC 11—"Nerva-Plast" cold-setting cement for protecting outdoor heat-insulated pipe lines against cold, heat and corrosion — Rubber & Plastics Compound Co., Inc., 30 Rockefeller Plaza, New York 20. Composed of rubber and asphaltic hydrocarbons, on drying it forms a tough, resilient, weather- and waterproof elastic film on which acids and alkalies have no damaging effect, the manufacturer states. On bare pipe, a layer of heat insulation is applied, then brushed with the compound and covered with a corrugated aluminum jacket. The compound seals the joints of the jacket. In other cases, a coating of the compound is sufficient, but a final coat of aluminum paint is recommended.

Window Type Electric Room Air Conditioner

HPAC 12*—Window type room conditioners in ½ and ¾ ton models — Fresh'nd-Aire Co., 221 N. La Salle St., Chicago 1. The units draw fresh air in from the outside, filtering and dehumidifying it as they cool and circulate it through the room. A baffle arrangement enables the user to direct the cooled air out the side, out the front, or out both front and side simultaneously.


Conditioner

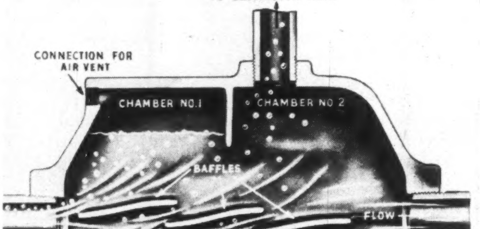

Boiler

Oil or Gas Fired Steel Boilers

HPAC 13**—"Windsor" horizontal-tube steel boilers, oil or gas fired, for commercial and industrial use — Portmar Boiler Co., Inc., 193 7th St., Brooklyn 15. Developed to meet a variety of heating demands for steam or hot water, the boilers have heavy gage steel boiler tubes, large furnace volume, long gas travels that permit complete absorbing of gases, and large hot water tankless copper coil, the company states. Boiler size range is: steam, 320 to 3000 sq ft; hot water, 510 to 4800 sq ft; larger boilers made to order. Operating pressures are steam, 15 lb; water, 30 lb.

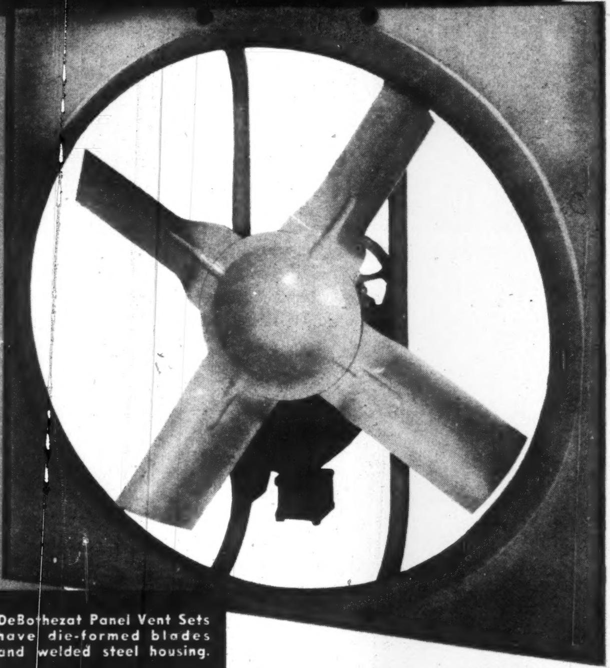
Air Eliminators for Hot Water Heating Systems

HPAC 14—"Air-Scoop" one piece unit for removing air from hot water heating systems — Taco Heaters, Inc., 137 South St., Providence 3. It requires no adjusting or re-draining of the system after installation, the manufacturer states. As air and water enter the unit, the air bubbles are scooped up by the first baffle and rise into the upper chambers. Air bubbles that get through the first baffle are scooped up by the second or third. Air



(*Continued on page 232*)

NEW Low Priced PANEL VENT SETS for Low S. P.



DeBothezat Panel Vent Sets have die-formed blades and welded steel housing.

BALL BEARING MOTOR
Totally enclosed ball bearing motor of nationally known manufacture. Non-overload power characteristic prevents motor burn-out.

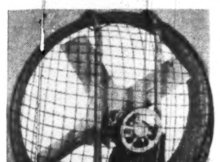
EASY TO INSTALL AT ANY ANGLE
Square panel and ball bearing motor construction make installation easy. Can be mounted vertically, horizontally or at any angle.

QUIET OPERATION
Slow speed "V" belt drive assures quieter operation. Cast drive sheave is accurately machined and carefully balanced.

MINIMUM TURBULENCE
Streamlined venturi directs air-flow into fan wheel with minimum turbulence.

SMOOTH RUNNING
Every Panel Vent Set is carefully balanced for smooth running.

DeBothezat Panel Vent Sets are made with fan wheels 24", 30" and 36" in diameter with certified capacities up to 13,190 CFM. These units are fully guaranteed.



Safety screen guards and shutters available as accessories.

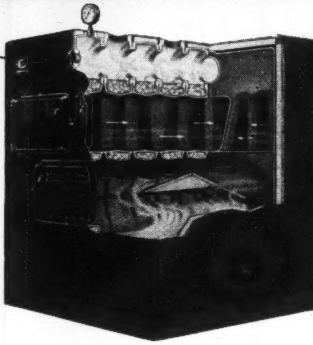
Certified Ratings
PFMA

SEND FOR FREE BULLETIN

DeBOTHEZAT FANS

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

AMERICAN-Standard
HEATING

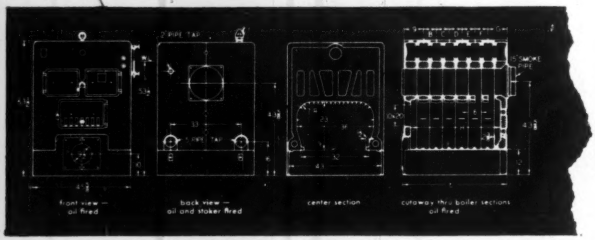


Improved design makes
New No. 3 REDFLASH Boiler
better than ever!

● Incorporating a heat-saving combination of finned heating element, correctly designed baffles, and long flue travel, the *new* No. 3 Redflash is an even greater boiler than before.

Made in models and sizes to meet the heating requirements of large homes, apartment houses and commercial establishments, these durable cast iron boilers can also be installed in battery to provide an extremely flexible heating plant for larger buildings. Available for steam or hot water heating, No. 3 Redflash burns all fuels. American-Standard heating equipment is sold through selected wholesale distributors to heating and plumbing contractors.

Quality Construction! Precision Engineering!



front view — oil fired

back view — oil and stoker fired

center section

cutaway thru boiler sections oil fired

DIMENSIONS, OUTLETS, INLETS
Tapped 2" for External Water Heater

BOILER NUMBER		Outlets Number and size	Inlets Number and size	DIMENSIONS—INCHES							
Steam	Water			B	C	D	E	F	G	H	L†
3-S-6*	3-W-6*	2 4"	2 5"	18	..	..	..	..	9	29⅜	36
3-S-7*	3-W-7*	3 4"	2 5"	12	12	..	..	..	9	35⅜	42
3-S-8	3-W-8	3 4"	2 5"	18	12	..	..	..	9	41⅜	48
3-S-9	3-W-9	4 4"	2 5"	12	12	12	..	..	9	47⅜	54
3-S-10	3-W-10	4 4"	2 5"	12	12	12	..	..	15	53⅜	60
3-S-11	3-W-11	4 4"	2 5"	12	18	18	..	..	9	59⅜	66
3-S-12	3-W-12	5 4"	2 5"	18	12	12	12	..	9	65⅜	72
3-S-13	3-W-13	5 4"	2 5"	18	18	12	12	..	9	71⅜	78
3-S-14**	3-W-14**	6 4"	2 5"	12	12	18	12	12	9	77⅜	84

*Coal, hand fired only. **Oil Fired (3-S or W-14-0) and Stoker (3-SC or WC-14) only.
†On Hand Fired add 21" to length for Smoke Hood. On Oil and Stoker Fired add 3¼" for Smoke Collar.

The new No. 3 Redflash is carefully designed and sturdily constructed for many years of completely automatic, carefree service. Note these important features as illustrated above:

Large disengaging area provides dry steam for fast, noiseless heating. Finned heat absorbing surface exposed directly to fire for extra efficiency. Refractory baffles bring hot flue gases into intimate contact with finned crownsheet. Scientifically designed and proportioned combustion space for greater efficiency. Flue passages provide exceptionally long flue travel and extract maximum heat from hot gases.

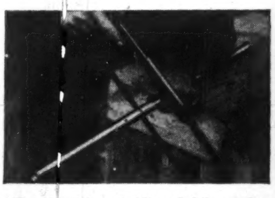
The **AMERICAN-Standard** *line means more business for you in '52!*

American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

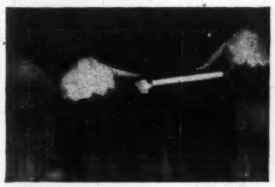
Serving home and industry

AMERICAN STANDARD · AMERICAN BLOWER · ACME CABINETS · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

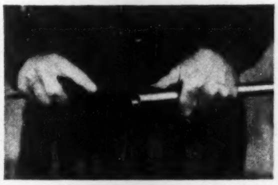
It's simple to make a good flared joint connection



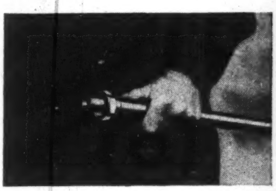
1 Unroll the coil of Chase Soft Temper Copper Water Tube. Cut off needed length with hacksaw.



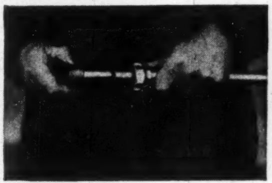
2 With a file or a reamer, remove all of the burs and smooth the inside edge of the tube at the opening.



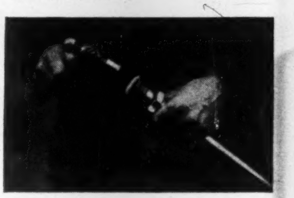
3 File off the burs and smooth the outside edge. Filing and smoothing make a snug fit at the fitting.



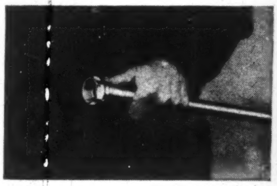
4 Slip the sleeve nut over the end of the tube. Be sure threads are toward the open end of tube.



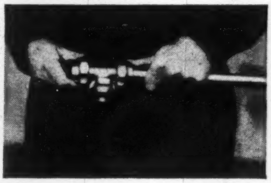
5 Choose a flanging tool corresponding to the size of tube. Cover tool shank with oil and insert into tube.



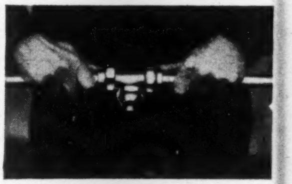
6 Hammer the end of the flanging tool until the edge of the tube fits into the undercut of the tool.



7 After flanging, draw sleeve nut to end of tube. It is now ready to be threaded onto the fitting.



8 Put a drop of oil on the inside surface of the flange. Insert fitting into the sleeve nut and tighten it well.



9 Fit the next tube in the same way. Screw up the sleeve nut tightly so as to make a strong connection.

THE EASE of making flared joints is only one of the many advantages of Chase Copper Water Tube.

CHASE TUBE is *soft tempered . . .* easy to bend around corners or form into U-bends. You'll appreciate this Chase feature in laying underground water lines and oil lines.

CHASE COPPER WATER TUBE is excellent for replacement work, too. It comes in long lengths up to 100 ft. that can be snaked between partitions and under floors, with a minimum of disturbance to existing construction.

FREE folders give details on making flared joints and solder-joint connections with Chase Copper Water Tube.

Chase Brass & Copper Co., Dept. HPA 352
Waterbury 20, Conn.

Please send me FREE Chase folders on Chase Copper Water Tube.

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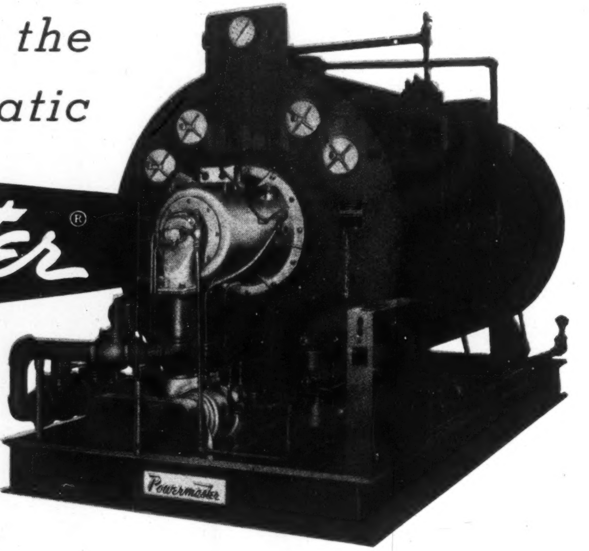
(†sales office only)

now you can reduce steam costs with the automatic

Powermaster®



Model 3 *Powermaster* — 15 to 500 H.P.; high or low pressure models for steam or hot water.

Exclusive burner design (patent applied for) is yours with the *Powermaster* steam generator. Compare this unit with others and you'll see why users are saving hundreds of dollars on fuel bills. Only the *Powermaster* gives you these 3 definite ways to reduce your costs for steam or hot water—

1. *Use less fuel* when boiler operates between 100% and 30% of capacity. Special burner gives you full modulation in a wide range between high and low fire.

2. *Save clean-up time* and money because complete combustion of fuel gives practically smokeless and carbon-free operation. Case histories show that the *Powermaster* needs cleaning less often than other self-contained units.

3. *Change from oil to gas* (or gas to oil) in just a few minutes. Take advantage of low fuel rates, enjoy freedom from worry about fuel shortages.

only the Powermaster® gives you all 3 advantages

Your Customers and Prospects

are reading this message. It tells why the *Powermaster* gives outstanding performance for

- LOW PRESSURE steam or hot water for heating
- HIGH PRESSURE steam for processing

We'll be glad to send you more information.

Write for this catalog

that gives you the entire story of the *Powermaster* steam generator. Just ask for Catalog 1218 and we'll put one in the mail for you.

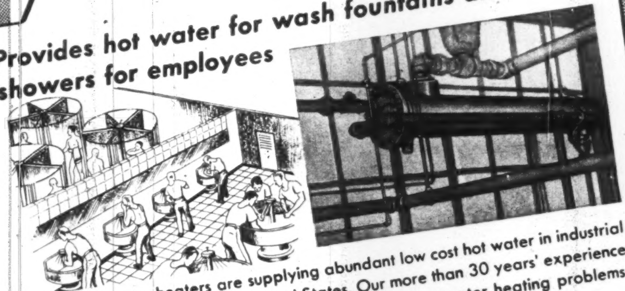
ORR & SEMBOWER, INC., *Established 1885*
940 Morgantown Road, Reading, Pennsylvania

TACO *has a proved record of helping*

FACTORIES · OFFICE BUILDINGS · SCHOOLS · HOSPITALS · CHURCHES · STORES

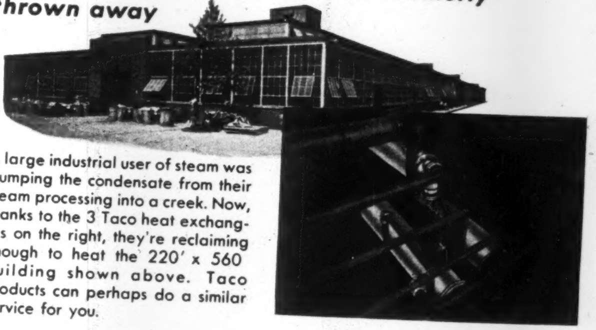
SOLVE THEIR HEAT and HOT WATER PROBLEMS . . .

Provides hot water for wash fountains and showers for employees

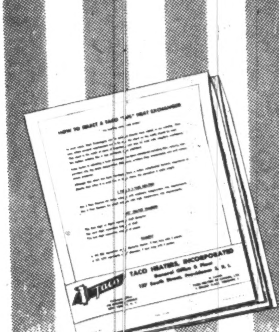


Taco water heaters are supplying abundant low cost hot water in industrial plants throughout the United States. Our more than 30 years' experience in this field is a big help to those with hot water heating problems.

Heats entire building with heat formerly thrown away



A large industrial user of steam was dumping the condensate from their steam processing into a creek. Now, thanks to the 3 Taco heat exchangers on the right, they're reclaiming enough to heat the 220' x 560 building shown above. Taco products can perhaps do a similar service for you.



ENGINEERS . . . WRITE FOR

simplified selection chart for sizing Taco water heaters under any conditions such as steam pressure, temperature rise and pressure drop.

Better Heating-Better with Taco

TACO HEATERS, INCORPORATED

A TRAINED TACO SALES ENGINEER IS AVAILABLE WHENEVER YOU NEED HIS HELP

Taco

137 SOUTH STREET · PROVIDENCE 3, R. I.

GRABLER
SQUARE "GEE" PIPE HANGERS
Give Relief from Time-Wasting Grief

Approved by Underwriters' Laboratories

Double check to find the difference in pipe hangers. There is a difference and it becomes apparent when journeymen use them. The difference results from engineered time-cost saving features. One way to discover the difference in pipe hangers is to use Square "Gee" Pipe Hangers on your next plumbing and heating jobs. You'll find that Grabler Square "Gee" Pipe Hangers give relief from time-wasting grief. Order them from your wholesaler.

Write for Wall Chart showing complete range of types of Grabler Square "Gee" Pipe Hangers and accessories.

THE GRABLER MANUFACTURING CO.
6565 BROADWAY, CLEVELAND 5, OHIO

THE SQUARE "GEE" LINE INCLUDES: Malleable Fittings • AAR Fittings • Unions • Rail Fittings • Cast Iron Steam and Drainage Fittings • Patented Drainage Fittings • Copper Tube Solder-Joint Fittings • Steel Pipe Nipples • Hangers

Approved by Underwriters' Laboratories

Approved by Underwriters' Laboratories

GRABLER

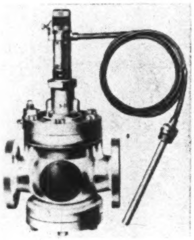
[illegible]

(Continued from page 226)

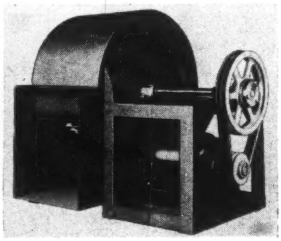
that accumulates in chamber No. 1 (see illustration) is removed from the system by the air valve, and air from chamber No. 2 passes into the expansion tank to act as an air cushion. Should the air completely fill the expansion tank and back down into the unit, the excess is removed by the air valve without disturbing operation of the system, according to the company.

Self-Operated Temperature Regulator

HPAC 15—Type 1005 self-operated temperature regulator designed for rapid field disassembly (for relapping and cleaning) — Farris Stacon Corp., 563 Commercial Ave., Palisades Park, N.J. It has visual dial control, built in strainers to protect the pilot and main valves, stainless steel seats and discs, and internal porting. Control accuracy of plus or minus 1 deg F is effected by the single seated pilot which operates on a vapor flash principle, and 99 percent of the power to position the valve is taken from the steam, 1 percent from vapor expansion, the manufacturer states. The regulator is self contained and pilot operated in sizes of 2 through 4 in. It is available with 125 or 250 lb ASA flanges for steam pressures from 10 to 150 psig, and for temperature control from 30 to 325 F. Adjustment range is 60 deg F.



Regulator



Blower

Belt Drive Blowers

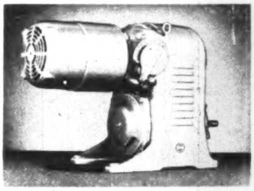
HPAC 16—New sizes in belt drive utility blower, including smaller units for electronic cooling, and larger ones for general drying, exhaust, ventilation and air driven conveyor systems — Fan and Blower Div., The Peerless Electric Co., 1401 W. Market St., Warren, Ohio. The company's blowers now are available with 9 to 30 in. diameter wheels, in ratings of from 1/6 to 7½ hp. Incorporated are adjustable pulley speeds, vibration dampeners, weatherproof covers and interchangeable motors.

Acid Resistant Plastic Material for Use in Pipe Lines, Valves, Tanks, etc.

HPAC 17**—"Boltaron 6200" plastic material, designed to withstand wear, resist almost all chemicals, and provide a combination of high tensile strength, light weight (1/6 that of stainless steel), high impact strength and abrasion resistance — Bolta Products, Inc., 151 Canal St., Lawrence, Mass. Typical applications include chemical and waste disposal pipe lines, valves and other pipe fittings, tanks, spray nozzles, plenum chambers, filters and strainers, wire insulations, fan housings, and electrical conduits. The material is a rigid non-plasticized polyvinyl chloride of high molecular weight. It may be used in industrial processes where acid corrosion and oxidation below 165 F are basic problems, and it may be welded, molded, extruded, fabricated and machined after welding. It is being distributed in the U.S. exclusively by the Industrial Plastics Div., H. N. Hartwell & Son, Inc., Boston, in the form of sheets, rods, fabricated parts, fittings and molding compounds.

Motor Control Center

HPAC 18**—Motor control center for use where two or more a-c motors (up to 200 hp, 600 volts) are controlled from a central location — General Electric Co., Control Dept., Schenectady 5. The center is pre-engineered, factory wired and assembled, and employs many standard components and accessories. It is designed to provide a simplified method of installing and servicing a-c combination motor starters in NEMA sizes 1 through 5, as well as lighting panels and associated equipment. According to the manufacturer, it withstands short circuit stresses up to 25,000 amp. Its sections, each 20 in. deep, 20 in. wide and 90 in. high, join to form a free standing, dead front, NEMA I enclosed control assembly. A 4 in. vertical trough runs the length of each section, providing space for wiring. Units may be installed from the front or rear of the section and are designed in even multiples of 14.



Above: Motor

Left: Control Center

Explosionproof Variable Speed Motor

HPAC 19—Explosionproof "Varidrive" motor for variable speed applications in dangerous locations — U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54. The new design eliminates intermediate connections, being self contained and mounted in one frame. Air movement is blasted over the enclosed unit from the exterior by a sparkproof fan housed within the end sector. Immediate speed change is provided when the control dial is turned. The motor is available in output speeds of from 2 to 10,000 rpm in ratings of 1 to 20 hp.

Air Conditioning Unit for Van Housing Electronic Equipment

HPAC 20**—Unit for heating and cooling a special type of army van which houses electronic equipment — U.S. Thermo Control Co., 44 S. 12th St., Minneapolis. Inside thermometer reading must be held constant, since the electronic equipment requires a narrow temperature range for optimum operation. To meet further requirements, the unit was designed to operate at temperatures ranging from –65 to 125 F, and to remain in good working condition after being stored for long periods at temperatures as low as –80 F.

Mueller Climatrol Gas Boilers Must be Good!

They're
Triple Tested
Type 20 Gas Boiler —from 315,000 to 3,780,000 Btu for steam and hot water.

to assure continued, trouble-free performance

Yes, every Mueller Climatrol boiler is hydrostatically *tested three times* before shipment—at three separate stages of manufacturing. When these boilers leave the factory, they are right! No wonder Mueller Climatrol Boiler installations are renowned for trouble-free operation and long life.

Mueller's sectional design gives you close-to-size capacities for any job; check these advantages:

- Wide range of residential and commercial sizes — from 54,000 to 3,780,000 Btu input.
- Cast iron, sectional. Precision-machined gas-tight flue passages. Maximum heat transfer.
- Patented V-venturi; cast-iron burners; easily accessible.
- Modern, attractive styling. Easily cleaned through access panel without removing casing.
- American Gas Association approved; conform to ASME Code. Backed by 27 years gas boiler manufacturing experience.

Choose Mueller Climatrol gas boilers for all your steam or hot-water heating or hot-water supply jobs — it really pays. Write for complete details. *L. J. Mueller Furnace Company, 2023-X Oklahoma Avenue, Milwaukee 15, Wisconsin.*

95th Anniversary **Mueller Climatrol**

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UNARCO
MAINTENANCE SAVINGS
for Commercial Uses, too!

HERE'S EVERYTHING YOU WANT:
EFFICIENCY, ECONOMY, LOW MAINTENANCE

Versatile Unarco Amocel brings many proved advantages to the broad fields of general service, for—like Unarco's higher-temperature insulation, Unibestos—it's light, resilient, strong; won't pulp, powder, wash-off, or shatter. It withstands impact and vibration; is unaffected by moisture, steam, fumes, or the usual acids. No breakage in transit. Easy to cut and fit on-the-job. May be removed and reapplied repeatedly without damage or loss of efficiency. Insulating with Amocel is quick and clean—saves maintenance time and money. Get all the facts today.

Amocel is made in standard 3-foot lengths, and furnished as matching pairs of half-rounds with jacket applied. Metal bands included. Your Unarco Distributor has Amocel in stock. Call him, or write for literature.

UNIBESTOS-TYPE
Amocel

FOR TEMPERATURES TO 600°F.
PIPE SIZES TO 12″

- **THE SAME** outstanding material—African Amosite.
- **THE SAME** attention to quality processing.
- **THE SAME** convenient application.
- **THE SAME** durability features.

Yet Unarco's long-lasting Amocel costs no more than ordinary pipe insulations.

UNARCO

UNION ASBESTOS & RUBBER COMPANY

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UNARCO

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Eastern Refractories Co., Inc.

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Competent sales engineers are always at your service for suggestions and recommendations, and deliveries are speeded throughout the area by a fleet of Company-owned trucks.

With 25 years of experience in the field, Eastern Refractories can give you helpful application information, broad selection, and prompt shipments on all Unarco insulations from six branch offices and warehouses. Write, wire, or phone the nearest location.

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WORCESTER, MASS., 13 Gardner Street; WOrcester 5-1355
PAWTUCKET, R. I., Dunnell Lane; PAwtucket 2-5178
LEWISTON, ME., 60 Holland Street; LEwiston 2-7581
MONTPELIER, VT., 167½ Barre Street; MOntpelier 1083
TROY, N. Y., 357 First Street; AShley 2-2715

INDUSTRIAL Insulations

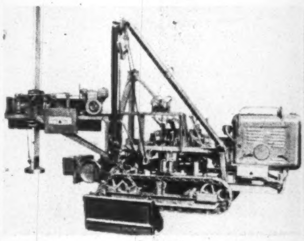
PRODUCTS OF

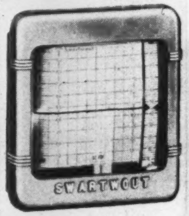
UNION ASBESTOS & RUBBER COMPANY

Powered by a gasoline engine, and weighing about 1400 lb, the system can service a van of 1500 cu ft or more in size, the manufacturer states. It will be installed in the upper leading edge of the van, and is soon to be tested at Fort Belvoir, Va.

Tamper-Backfiller-Side Crane

HPAC 21—Model 80 one man operated machine that tamps and backfills while traveling, lays, unloads and handles pipe, sheathing, etc., and does light crane work — The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland. It is mounted on a crawler having 24 travel speeds, ranging from 1 fpm to 2⅛ mph. The machine tamps while traveling either alongside of, or straddling, the trench. The backfiller is a conventional drag line type with a telescopic boom.


Crane

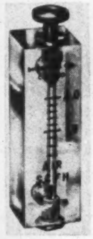


Recorder

Recorder

HPAC 22*—Independently powered "Autronic" miniature strip chart recorder with an electronically actuated pen — The Swartwout Co., 18511 Euclid Ave., Cleveland 12. It is the graphic indicator for the company's control system, for use in chemical and food processing plants, industrial power plants, etc. The pen records over the range of 0.0 to 0.500 volts a-c.

Flow Meters



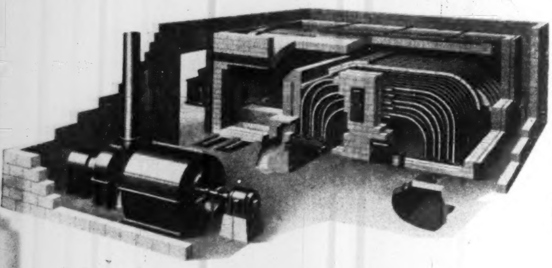
HPAC 23—Flow meters designed to provide immediate, accurate reading of line flow, regardless of change in flow rate of gas or air in laboratory test work, or when used as a replacement for sight feed bubblers — F. W. Dwyer Mfg. Co., 317 S. Western Ave., Chicago 12. The instruments are of solid acrylic construction and are precision drilled. The standard unit includes a built in control valve. Single units or one piece multiple units for 0-2 cfh to 0-10 cfh at standard conditions are made for front of board or flush panel mounting, with mounting holes furnished to specifications. Special flow meters are available for liquids or gases, flush or surface mounted with any type of connectors. Maximum conditions are 0-3 cfm air and 75 psi.

Low and High Pressure Shutoff Valves

HPAC 24—"Sentry" shutoff valves, improved to provide maximum protection against reduced or excessive flow through all types of pressure lines in plants and public buildings — McRae Valve Corp., 3511 W. 6th St., Los Angeles. They can be set to close within ½ oz of predetermined low or high pressures (dual spring control making this possible), and cannot close prematurely, the

LEE

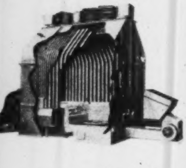
BRICK-SET
TUBULAR
HEATER



THE BRICK-SET TUBULAR HEATER

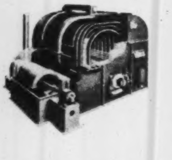
Model BST Brick-Set Tubular Heater, Capacity 2,000,000 b.t.u. to 10,000,000 b.t.u. for permanent central heating installations. The finest space heater ever manufactured.

the LEE line . . .



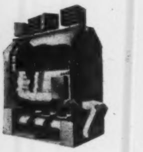
Vertical Tubular Heater

Model VTH Vertical Tubular Heater, Capacities 2,000,000 b.t.u. to 6,000,000 b.t.u. Can be used with or without duct distribution. Portable — requires no special foundation. Ideal for pre-heating large volumes of replacement air.



Steel Encased Tubular Heater

Model TSE Steel Encased Tubular Heater, Capacities 2,000,000 b.t.u. to 6,000,000 b.t.u. for permanent central heating installations. Ideal for space heating, mine ventilating, coal and ore thawing, drying problems.



"Packaged" Unit Heater

Model HD "Packaged" Unit Heater, Heavy duty capacities 300,000 b.t.u. to 2,000,000 b.t.u. Portable. Automatic for oil or gas or combinations. Completely factory assembled and tested.

SPECIFY LEE
Completely engineered heating.

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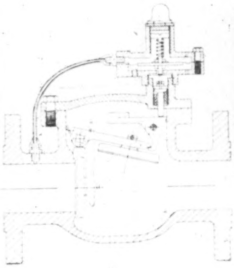
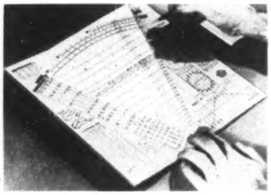
CORPORATION
1001 TATNALL STREET
WILMINGTON, DELAWARE

manufacturer states. Once reduced or excessive pressure causes valves to close, they form a line seal until reset by hand. The diaphragm control section is not in the line stream, being a separate unit. Destruction of this control by fire, explosion, etc., causes the valves to close immediately. Standard valves are available in 1 to 6 in. sizes, in bronze or semi-steel.





Above: Computer

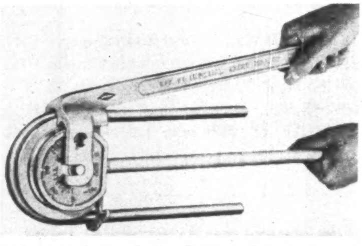
Left: Valve

Computers for Pipe Layout

HPAC 25**—Computers, with pointers made of "Vinylite" plastic rigid sheet, which require only four measurement readings to mark a pipe (by quadrants) at 16 different ordinate points on the circumference — Bakelite Co., 122 E. 42nd St., New York 17. The plastic insures the same readings under varying weather conditions, the manufacturer states. The computer gives direct readings for any angle of bend up to 126 deg, in steps of 1 deg or less, on pipe diameters from 1 to 20 in. The instrument gives distances in inches along the pipe from a vertical center line.

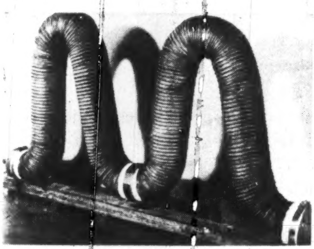
Tube Bender

HPAC 26—Combination tube bender that bends both ½ and ⅝ in. OD copper, aluminum, brass and other soft, thin wall metal tubing — The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7. The tool has a dual size shoe and mandrel. Being of two piece construction (enabling it to slip over the tube where the bend is needed), it can be used to bend tubing where one end is connected. Bends can be made to any angle up to 180 deg.



Flexible Ducting for Air Conditioning and Ventilating

HPAC 27—"Flexflyte" fiber glass ducting for air conditioning and ventilating, which can be snaked through existing floors and walls for installation — Flexible Tubing Corp., Guilford, Conn. The ducting consists of a fiber glass fabric cemented to a continuous steel spring wire helix, bound with glass fiber cord, and bonded together with a special elastomeric compound. It can be cut to any desired length with simple tools, and is flameproof, resistant to fungus and mildew, and will stand up under a wide range of temperatures, the manufacturer states.



Ducting

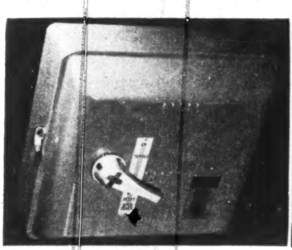
Meter

Sound Level Meter

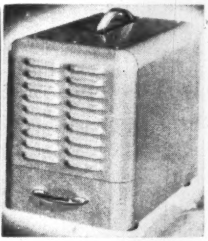
HPAC 28**—Type 410-B sound level meter for measuring noise, sound, and vibration from equipment such as blowers and ventilating fans — Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39. It utilizes subminiature tubes and components similar to those in proximity fuses. The meter meets all ASA specifications for sound level meters, the manufacturer states. The sound level range is from 34 to 140 db above the standard ASA reference level of 0.0002 dynes per sq centimeter.

Motor Starter

HPAC 29—Combination across the line motor starter with circuit breaker, in which the components are mounted side by side — Westinghouse Electric Corp., Box 2099, Pittsburgh 30. It is available in sizes 0, 1 and 2 in sheet steel enclosures for NEMA types I, IA, and V.



Starter



Dehumidifier

Portable Dehumidifier

HPAC 30*—Model 750 portable electric dehumidifier, designed to save space (overall dimensions are 17 in. high, 12 in. wide, 18 in. long) — Fresh'nd-Aire Co., 221 N. La Salle St., Chicago 1. It weighs 58 lb, and contains a removable drawer for water collection. For drain disposal, the drawer is removed. The unit dehumidifies areas of up to 10,000 cu ft, removing 2 to 3 gallons of moisture in 24 hours, the company states. It has a 1/8 hp condensing unit, and operates on a 115 volt, 50 or 60 cycle a-c current.

Room Air Conditioners

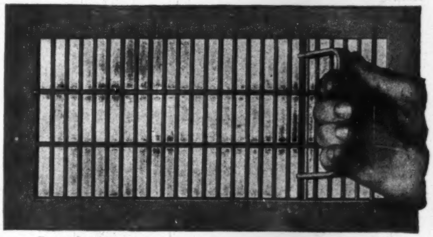
HPAC 31—1952 line of room air conditioners, consisting of seven models with four cooling capacities, 1/3, 1/2, 3/4 and 1 ton, and featuring, in the 3/4 and 1 ton models, operating voltages of 110, 230 and 208 — Mitchell

INDEPENDENT

"Fabrikated" WALL GRILLES
for Commercial Installations

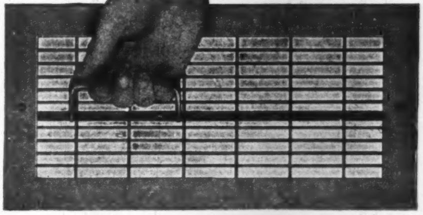
PROVIDE ADJUSTABLE
DIRECTED AIR FLOW

321-A



UP OR
DOWN

RIGHT
OR LEFT



311-A

Made to fit openings in even inches from 8" x 4" to 60" x 40"

Independent Fabrikated* Adjustable Grilles (patented), rigidly constructed with stamped steel rims and steel bars, are made with either vertical or horizontal grille bars. Grille bars are *adjustable* before or after installation; available also with bars permanently set for straight flow.

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*Reg. U. S. Pat. Off.

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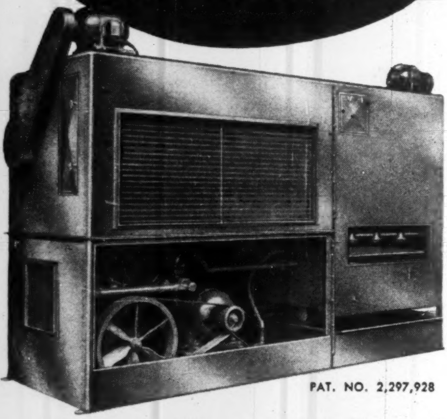
COMPLETELY PACKAGED
AIR CONDITIONER



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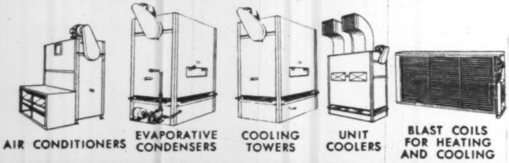
Name your job . . . any air conditioning job requiring from 3 to 50 tons . . . and you'll find that you can't beat a Governair system for day in, day out dependability.

Governair Packaged Air Conditioners are designed to operate at peak efficiency—with all parts precision-matched to work together. And they're built to give years and years of low-cost, trouble-free service.

Choose Governair . . . and you choose the best!



ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

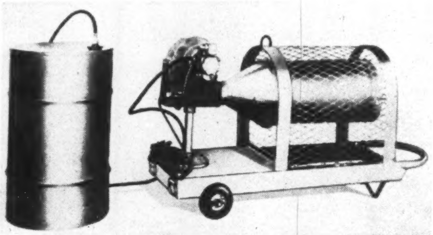
GOVERNAIR

GOVERNAIR CORPORATION • 513 N. BLACKWELDER • OKLAHOMA CITY, OKLA.

Mfg. Co., 2525 N. Clybourn Ave., Chicago. Turning the new motor controlled knob effects control of two adjusted levels of cooling and dehumidification together with control of ventilation and two speed air exhaust. Also featured are a new sound muffler and dryer.

Portable Space Heater of the Radiant Type

HPAC 32—No. 200 portable space heater of the radiant type, rated at 189,000 Btu — Quiet Automatic Oil Burner Corp., 33 Bloomfield Ave., Newark, N.J. It is equipped with solenoid valve and the company's oil burner. The combustion chamber incorporates a split baffle that circulates air around the outside of the chamber and at the same time supplies air to the burner for combustion purposes.

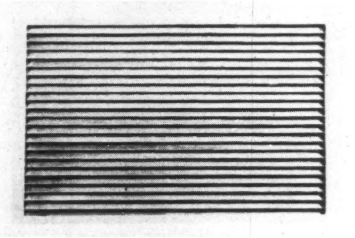


Stainless Steel Coating for Metal Surfaces

HPAC 33—Stainless steel coating for protecting metal surfaces against rust, corrosion and other types of deterioration caused by salt air and water, industrial atmospheres, alkalies, oils, most strong acids, heat, etc. — Steelcote Mfg. Co., 3418 Gratiot St., St. Louis. The film is non-inflammable, odorless, takes fungus treatments, and dries for use in 3 to 4 hours after application (brush or spray) the manufacturer states.

Door and Partition Grille

HPAC 34—Door and partition grille designed to avoid rattle when door is slammed — Titus Mfg. Corp., 113 E. 8th St., Waterloo, Ia. The one piece frame is reinforced on either side, and heavy gage steel is used throughout. Louvers are V shaped, and grilles, coated with a prime finish, are adaptable to any door width, the manufacturer states.



Blading for Large Capacity Centrifugal Fans

HPAC 35—Centrifugal fan wheel with airfoil blading designed to provide air flow with a minimum of turbulence —Westinghouse Electric Corp., Sturtevant Div., Hyde

THE GUIDE 1952
READY MARCH 25th

— to give you all the right answers to your problems in Heating, Ventilating, and Air Conditioning

HEATING VENTILATING AIR CONDITIONING
GUIDE
1952
HEATING VENTILATING AIR CONDITIONING
GUIDE
1952
EDITION
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AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Use This Book as thousands do for ready reference and to help solve heating, ventilating and air conditioning problems. All chapters edited, revised and brought up-to-date by experts in their respective fields. Glance below and see what a wealth of practical data this big, 1496 page book contains.

SPECIAL FEATURES OF THE GUIDE 1952

50 chapters on subjects of greatest interest to heating, ventilating, and air conditioning engineers.
Design tables for solar heat gain through roofs, windows, glass block, and figured rolled glass.
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TYPICAL SECTIONS

AIR CONDITIONING SYSTEMS: Equipment arrangement, and operation for year 'round air conditioning explained simply. Cost of owning and operating outlined. AIR CONTAMINANTS: Nature and control of contaminants in air discussed, and limits indicated. AIR DISTRIBUTION: Standards and methods for proper air distribution given. Formulas and charts included to aid in selection of outlets. AIR DUCT DESIGN: Includes ASHVE Air Friction Charts, together with basic formulas and tables for rectangular equivalents of round ducts and friction loss in elbows. Practical design for duct system illustrated.

CHIMNEYS: Theory and actual operation of large and small chimneys considered. Formulas and charts for selecting residential chimney sizes included. CODES: Latest editions and sources of 140 codes and standards compiled for ready reference. COOLING LOAD: Weather design data for 316 localities listed. Solar heat gain tables included for glass, glass block, and figured rolled glass from ASHVE research. Simplified method shown for computing heat gain through walls and roofs. Steady state and periodic heat flow discussed. DRYING SYSTEMS: Theory and methods of drying outlined. Typical drying equipment illustrated. FLUID FLOW: Basic theory of fluid flow through pipes, nozzles, and orifices presented clearly and concisely.

FUELS, COMBUSTION, AND EQUIPMENT: Gives properties of present-day fuels and their combustion data. Adjustment and operation of fuel-burning equipment explained. HEAT LOSS CALCULATIONS: Includes basic formulas and extensive tables for determining building heat loss for typical construction. Weather design conditions given for U. S. and Canadian cities. HEAT TRANSFER: Basic formulas applying to heat transfer by conduction, convection, and radiation are developed. Unit conductances for thermal convection for various surfaces are tabulated. Net radiation solutions for various relative positions of surfaces are given.

HEATING SYSTEMS: Various types of steam, hot water, panel, warm air, and all-year comfort systems described. Data for determination of pipe and duct sizes. INSTRUMENTS: Outlines methods of measurement and instruments used in heating, ventilating and air conditioning. PANEL HEATING: A simple method for design of panel heating systems. PHYSIOLOGICAL REACTIONS: Basic data and standards for comfort, explains reaction of human beings to atmospheric environment outside comfort range. Includes ASHVE Comfort Chart. Shows value of air conditioning in prevention and treatment of disease. REFRIGERATION: Simple presentation of different refrigeration cycles, types and functions of equipment, and controls. Outlines factors affecting use of the heat pump. THERMODYNAMICS: Simple discussion of thermodynamics in air conditioning, with illustrative problems showing use of ASHVE Psychrometric Chart and tables of properties of air from —160 F to +200 F. WARM AIR SYSTEMS: Design of gravity and forced circulation systems, simplified by use of tables. Perimeter and ceiling panel systems described. WATER SERVICES: Shows how to determine service water demand, pipe sizes for cold and hot water systems, for cooling towers and for refrigeration. Data for selection of heater and storage tank capacity.

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● It rolls right through any pipe with least effort, quick almost burrless cuts—factory tested, tracks perfectly. Special thin-blade cutter wheel for extra fast cutting—or heavy-duty wheel for extra long service. Guaranteed warp-proof special malleable housing. Five models to 6″ pipe; 4-wheel short-handle models for speedy cutting in tight places. For tops in clean, easy pipe cutting, buy RIDGID Cutters at your Supply House.

RIDGID
★ Work-Saver Pipe Tools ★

Park, Boston 36. In the airfoil fan, the blade cross section is similar to that of an airplane wing — tear-drop shaped and curved backwards from the direction of rotation. Such a blade is intended to exert positive pressure on the air over its entire face from the leading edge to the trailing edge. Recent tests on a scale model of the fan wheel showed it to be mechanically efficient while developing little noise energy, the manufacturer states.

WE HEAR THAT . . .

Observance of the 90th anniversary of *THE LUNKENHEIMER CO.* keynoted the firm's recent 1952 sales conference in Cincinnati. Company officials and personnel from the U.S. and many foreign countries participated.

ECONOMY PUMPS, INC., formerly of Hamilton, Ohio, is now a division of *C. H. WHEELER MFG. CO.* Engineering and manufacturing operations of the companies have been consolidated in Wheeler's Philadelphia plant, where facilities are now being expanded.

The firm name of *CHICAGO METAL HOSE CORP.*, Maywood, Ill., has been changed to *FLEXONICS CORP.* The change does not affect the corporate structure, management, personnel or policies of the company, which is marking its golden anniversary this year.

A technicolor motion picture, *Walls Without Welds*, showing the making of seamless steel pipe and tubing, has been produced for The National Tube Div., *UNITED STATES STEEL CO.*, Pittsburgh. It will be presented to engineering and trade organizations, and will be available to high schools, universities, and other groups.

Recently a group of British industrialists, in this country under the auspices of ECA, visited the Chicago plant of *ILG ELECTRIC VENTILATING CO.* The group is studying preventive maintenance methods in American plants.

More than 300 officers and personnel attended the recent 25th annual managers' and salesmen's meeting of *HAJOCA CORP.* in Philadelphia.

CAMBRIDGE CORP., Syracuse, has established a mechanical division for handling its development and manufacturing program in the extreme low temperature field. Headquarters are in Somerville, Mass. *ROGER S. WARNER, JR.*, has been named vice president and project manager of the division.

Fifty years of service to the building trades are being commemorated this year by *INLAND STEEL PRODUCTS CO.*, Milwaukee. There are tentative plans for an official observance later in the year.

Seamless stainless steel tubing recently was produced for the first time on the new hot extrusion facilities of *THE BABCOCK & WILCOX CO., TUBULAR PRODUCTS DIV.*, Beaver Falls, Pa. The plant is the first operating in the U.S., which is designed specifically to produce stainless steel tubing by the "Ugine-Sejournet" extrusion process, the company states.

A new, sound color film, *Corrosion in Action*, prepared under the direction of the corrosion engineering section, *THE INTERNATIONAL NICKEL CO.*, New York, will be shown for the first time this month at the annual conference and exhibition of the National Association of Corrosion Engineers at Galveston. It presents various methods for avoiding or controlling corrosion damage.

CHASE BRASS & COPPER CO., Waterbury, Conn., has developed a new carton designed to facilitate the shipping, storage and identification of its copper water tube.

The new $1,800,000 Euclid, Ohio, plant of *RELIANCE ELECTRIC & ENGINEERING CO.*, Cleveland, recently was put into operation, as 425 employees finished the two week job of moving in. A brief plant opening ceremony was held.

ALLEGHENY LUDLUM STEEL CORP., Pittsburgh, has purchased a 160 acre industrial site on the Allegheny River, three miles north of Freeport, Pa. It will provide for future expansion of the company in the Pittsburgh district.

The Magnesium Sales Dept., *THE DOW CHEMICAL CO.*, Midland, Mich., has assumed distribution of cathodic protection products from *DOWELL, INC.*, a wholly owned subsidiary. The change was made to effect closer coordination between research and development, production, and sales of magnesium anodes.

At a recent week-long sales forum in Auburn, N.Y., sales for the room air conditioners of *REMINGTON AIR CONDITIONING DIV., REMINGTON CORP.*, were reported to have increased 30 percent during 1951. Regional sales and service managers from throughout the country attended the meetings.

THE C. E. SQUIRES CO., Cleveland, has acquired the assets and equipment of *THE MOUAT VAPOR HEATING CO.*, Cleveland, and will manufacture its heating specialties, which will be merchandised through Squires' network of manufacturers' representatives. The new products include radiator traps, air vents, boiler cleaner compound, etc.

CONSOLIDATED SUPPLY CO. and *UNIQUIP, INC.*, have been merged into *CONSOLIDATED SUPPLY CO., INC.*, with offices at 11 W. 25th St., Baltimore 18.

RCA VICTOR DIV., RADIO CORP. OF AMERICA has become a member of the *AIR CONDITIONING AND REFRIGERATING MACHINERY ASSOCIATION*.

YORK CORP., York, Pa., has begun work on two contracts, totalling over $2 million, involving special machine tools for aircraft production. . . . . A giant extrusion press, leased from the U.S. Air Force, is being installed at the Lafayette, Ind., works of *ALUMINUM CO. OF AMERICA*. It is the largest in the country, the company states.

Exclusive New Quick-Opening

Quadritype Die Heads

ON THE NEW

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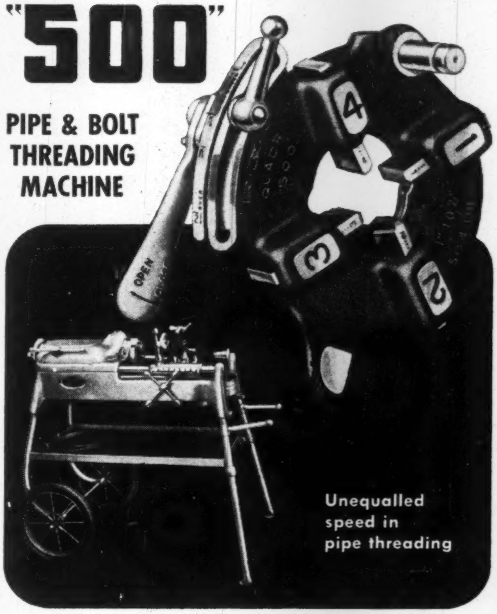
"500"

PIPE & BOLT THREADING MACHINE



New "500" Quadritype Die Head can be instantly adjusted from 1" to 2" regardless of position of quick-opening lever—and without removing dies or die head from machine.

★ Also improved Dualtype Die Heads, one for ¼" and ⅜", one for ½" and ¾", same instant size change *right in the machine*.

★ Also separate Monotype Die Heads available, ⅛" to 2", bolt die heads, ¼" to 2".

★ All tools in the "500" thread, cut, ream independently, and right up to chuck, swing out of way when not in use.

★ With a score of other sensational new features! See the new RIDGID "500" at your Supply House.

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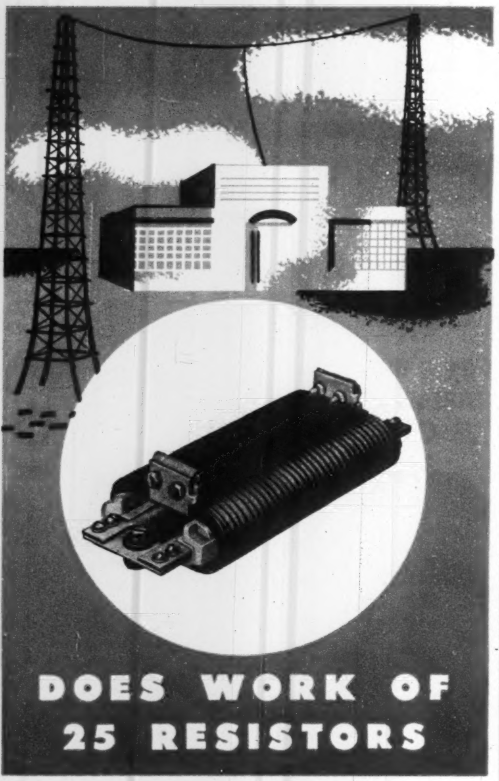


**saves work—and cost—
of hooking them up**

It used to take 25 conventional resistors, 11¾ x 1⅛ in., spaced on 2½ in. centers, to keep the power company happy.

Ward Leonard worked out the problem with a *single* Edgeohm resistor, 19 in. long—saving all that space, weight, mounting and wiring.

Here's the application: a 40-kw radio transmitter, operating from a 50 kva transformer, made by a large transmitter manufacturer. Problem: limiting inrush current to avoid a severe voltage drop (objected to by the power company) and a strain on the line contactor.

This single Edgeohm unit is rated for continuous duty at 2200 watts, and when used for a 15-second interval, will dissipate 6400 watts!

Another example of Ward Leonard "Result Engineering", providing the desired result at a saving! WARD LEONARD ELECTRIC CO., 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

**WARD LEONARD
ELECTRIC COMPANY**
Result-Engineered Controls Since 1872
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

WHO'S WHAT

FRANK J. NUNLIST, JR., has been named general sales manager of the *L. J. MUELLER FURNACE CO.*, Milwaukee, succeeding *C. L. HEWITT, JR.*, who resigned and is moving to California. Mr. Nunlist is active in the Gas Appliance Manufacturers Association, the National Warm Air Heating and Air Conditioning Association, and the American Society of Heating and Ventilating Engineers. He has served on the furnace advisory committee for the National Production Authority.

PENN CONTROLS, INC., Goshen, Ind., has appointed *R. S. PENN* vice president for operations, and *E. B. MAIRE* vice president and director of sales. *J. M. REID*, controller, has been named a member of the executive committee, and *K. W. CASH*, formerly assistant sales manager, is now manager of control sales for refrigeration, air conditioning, engines, pumps and air compressors. *M. E. HENNING*, formerly executive vice president, has resigned.

At the recent annual meeting, three directors of *A. M. BYERS CO.*, Pittsburgh, were re-elected for three year terms. They are *H. B. HIGGINS*, president, Pittsburgh Plate Glass Co.; *ALAN M. SCAIFE*, chairman, Scaife Co.; and *J. W. MARRINAN*, Byers' vice president in charge of operations. *CARL G. JENSEN*, vice president and controller, who has served the company for over 37 years, has resigned, and *ROLF GRIEM*, assistant controller for the past eight years, has been elected controller. The other officers of the company have been re-elected.

The newly elected president of *DIAMOND POWER SPECIALTY CORP.*, Lancaster, Ohio, is *WILLIAM J. FITZBURGH*, who has been executive vice president since March, 1950. *WILLIS P. THOMAS* has been elected chairman of the board.

ANDREW B. STEVENS has been promoted to the post of assistant factory manager for *AMERICAN WHEELABRATOR & EQUIPMENT CORP.*, Mishawaka, Ind. He has been supervisor of production control and stores for six years.

J. A. MADDEN is now sales manager, *MAID-O-MIST, INC.*, Chicago. He has most recently been associated with Servel Inc., as eastern district sales manager.

THE AMERICAN AIR FILTER CO., INC., Louisville, Ky., has appointed *RAY ORTGIES* as foundry supervising engineer with its Dust Control Div. Formerly he was with Whiting Corp., which he joined in 1938.

S. B. CONLEY, with the company for more than 25 years, has been appointed merchandise manager of the new air conditioner department, *RCA VICTOR DIV.*, Radio Corp. of America, Camden, N.J.

WILLIAM A. BAUER, director of the foreign division of *AMERICAN RADIATOR & STANDARD SANITARY CORP.*, Pittsburgh, has been appointed to the firm's operating committee, which functions as an advisory board

Look here *first* when specifying expansion joints

Just "flexing" is not enough . . . it's Directed-Flexing Self-Equalizing — an exclusive Badger Mfg. Co. feature — that makes the real difference in expansion joint performance. The enlarged cross-section above shows the corrugated member in the unique *all-curve* pattern . . . no sharp bends or structure-weakening stresses . . . no danger of premature breakdown.

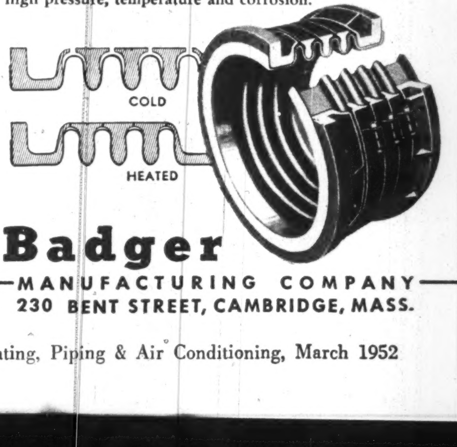
When combined with the correspondingly shaped Badger Self-Equalizing ring, a progressively controlled movement of each corrugation guarantees a more flexible longer lasting joint — a joint that succeeds where others fail. Get detailed information on the Badger Expansion Joint by writing today. Specify Badger Expansion Joints for every job.

Only Badger Expansion Joints have Directed-Flexing Self-Equalizing rings which progressively control the movement of the all-curve corrugations.

Plus 5 other big features

- Packless . . . pressure-tight single tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure-weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel alloys to withstand high pressure, temperature and corrosion.



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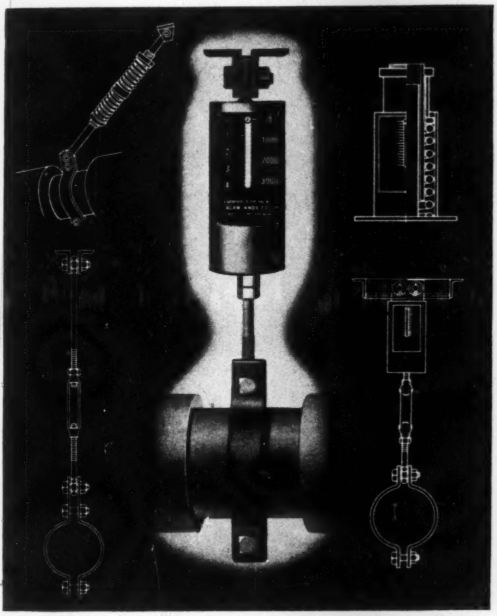
MANUFACTURING COMPANY
230 BENT STREET, CAMBRIDGE, MASS.



Do you know about

BLAW-KNOX PIPE HANGERS?

The Blaw-Knox line of *standard* Pipe Hangers and Supports meets the requirements of any piping system . . . eliminates the need to design special Supports for the job. Designers can proceed directly from hanger analysis to selection and application of hangers.

Catalog No. 51 contains a special Technical Section to help you quickly determine such factors as thermal movement, weight of piping materials and hanger location. If you are looking for ways to speed up hanger design, write for Catalog No. 51 on your company letterhead. No obligation.

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ADJUSTABLE PIPE HANGERS
VIBRATION ELIMINATORS
AND SUPPORTS

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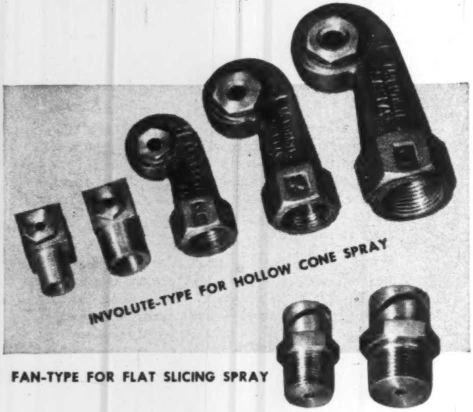
PIONEERS IN THE DEVELOPMENT OF
FUNCTIONAL HANGERS
VIBRATION ELIMINATORS

for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

YARWAY

SPRAY NOZZLES


INVOLUTE-TYPE FOR HOLLOW CONE SPRAY
FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for new Bulletin N-616.

YARNALL-WARING COMPANY
107 Mermaid Avenue Philadelphia 18, Pa.

to the president. *NICHOLAS H. RICHFIELD* has been named manager of the company's application selling department, succeeding the late *WALTER WEHNER*. He has been with the company since 1938.

WESTINGHOUSE ELECTRIC CORP., Pittsburgh, has re-assigned two vice presidents. *TOM TURNER*, who has been in charge of industrial relations and had staff responsibility for headquarters manufacturing, is now in charge of the motor and control division at Buffalo. *T. I. PHILLIPS*, until recently heading the East Pittsburgh divisions, succeeds Mr. Turner as staff vice president in charge of manufacturing.

EMIL P. NENSEL is now sales manager of the water heater division of *SERVEL, INC.*, Evansville, Ind. He has been with the company since 1936. A new air conditioning contract sales department has been organized, which will be managed by *R. M. ANDERSON*, with the company since 1945. The department will handle sales to chain store operators and other large scale national users of air conditioning equipment.

A new home heating and cooling department has been formed in the Air Conditioning Div., *GENERAL ELECTRIC CO.*, Bloomfield, N.J. *S. J. LEVINE*, who joined the company in 1928, has been appointed its general manager. Managing the newly organized heat pump department, is *H. M. BRUNDAGE*, who has been manager of the division's automatic heating department.

CLAYTON CARL, with the company since 1918, has been appointed superintendent of the West Point, Miss., works of *THE BABCOCK & WILCOX CO.*, New York. *ADIN B. CAPRON* has been named to the newly created post of chief engineer for the company's *TUBULAR PRODUCTS DIV.*, Beaver Falls, Pa. Most recently he has been superintendent of tube mills at the Beaver Falls plant. *RALPH J. CAROTHERS* is now chief inspector at that plant, and has been in the inspection department there since 1929. He succeeds *JAMES A. DeBEE* who died recently.

J. H. METZGAR, formerly a company sales engineer, has been appointed sales manager, Standard Products Div., *DE LAVAL STEAM TURBINE CO.*, Trenton, N.J. *C. E. CROMWELL*, most recently district manager of the Detroit office, is now sales manager, Commercial Div. The company has announced the formation of a subsidiary corporation, the *DE LAVAL TURBINE PACIFIC CO.*, with headquarters in the company's new building at Main and Folsom Sts., San Francisco. Officers are *G. W. SMITH, JR.*, chairman, *J. P. STEWART*, president, and *C. F. REEVES*, vice president and general manager. Mr. Reeves will be in direct charge of operations, continuing the duties he has held as west coast manager.

LOUIS G. GETTERMAN, M.D., has been appointed medical director at *YORK CORP.*, York, Pa. He has begun his duties at the company's new medical center.

JAMES P. GROWDON, chief hydraulic engineer for *ALUMINUM CO. OF AMERICA*, Pittsburgh, since 1938, is now an engineering consultant on hydraulic and related engineering problems for the company. *B. J. FLETCHER*, formerly assistant chief hydraulic engineer, succeeds Mr. Growdon.

F. F. STEVENSON has joined *GRAHAM, ANDERSON, PROBST & WHITE*, architects and engineers, Chicago, as a mechanical designer and specification writer. Previously, he was with the Austin Co.

ROBERT P. WILLIAMS, JR., and *CLARENCE GRAHAM, SR.*, have been elected vice presidents of the *RHEEM MFG. CO.*, New York.

General managers have been appointed for five newly created operating divisions of *OLIN INDUSTRIES, INC.*, East Alton, Ill. *M. W. ACKER*, director and vice president, will head the metals division, with headquarters at East Alton. *M. F. MEISSNER* is named assistant manager of the division.

WORTHINGTON PUMP AND MACHINERY CORP., Harrison, N.J., has appointed *B. A. BAUER* purchasing agent and supervisor of stores of the Oil City, Pa., plant. He has been most recently with National Transit Pump and Machine Co.

ROBERT N. NELSON, formerly assistant sales manager, is now sales manager, Pneumatic Div., *SUNDSTRAND MACHINE TOOL CO.*, Rockford, Ill.

MILTON L. EDGREN has been appointed a field service engineer in the transportation division of *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis. Formerly he was with the Pullman Co.

ROY F. BRISBOIS is now process pump specialist for Peerless Pump Div., *FOOD MACHINERY AND CHEMICAL CORP.*, Los Angeles. He has been with the division in sales work for the past five years.

WILLIAM R. FUNK has been named general sales manager for *DURANT INTERNATIONAL CORP.*, Williamstown, N.J. He was formerly associated with Acme Industries, Inc.

The new president of *DIAMOND IRON WORKS, INC.*, Minneapolis, and its *MFG. CO. DIV.* is *J. P. BLAUL*, succeeding *L. J. REAY*, who has resigned but will continue to serve as a member of the board of directors. Mr. Blaul joined the company in 1951, and prior to that, operated his own business.

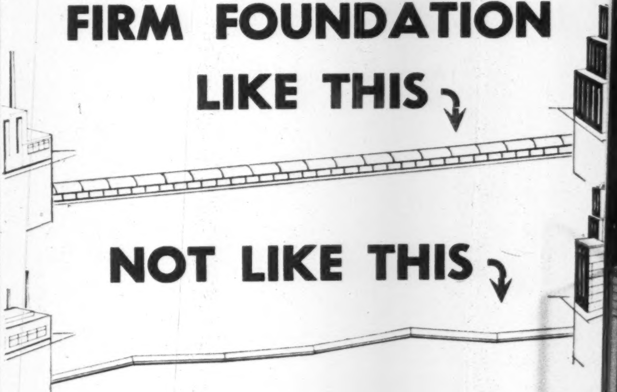
GEORGE M. LEVINE, formerly advertising manager and acting sales manager, has been appointed general sales manager of *CAPITOL MFG. & SUPPLY CO.*, Columbus, Ohio.

THE SAWHILL MFG. CO., Sharon, Pa., has named *ROY B. SIEGRIST* as assistant general superintendent. He has been associated with National Supply Co. and Kerotest Manufacturers Co.

HANS U. HJERMSTAD is now vice president in charge of engineering, *SOLA ELECTRIC CO.*, Chicago. He has been in charge of engineering development since 1948, as assistant to the president.

At a recent meeting of the mechanical dehumidifier section, *REFRIGERATION EQUIPMENT MANUFACTURERS ASSOCIATION*, *H. F. HILDRETH*, Westinghouse Electric Corp., and *L. C. LOVE*, The Ebco Mfg. Co., were elected chairman and vice chairman, respectively, of the product section. It was decided at the meeting to in-

MAKE SURE YOUR
Underground Conduit
has a
FIRM FOUNDATION

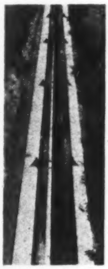


LIKE THIS

NOT LIKE THIS

The lower drawing is exaggerated purposely to make our point clear.

Unless your conduit rests on a firm foundation, the slightest upheaval due to freezing or temperature change, or the slightest settling, may change the slope sufficiently to create condensation pockets. Your troubles then begin. The solution is: install



THERM-O-TILE
Reg. U. S. Pat. Off.
UNDERGROUND STEAM CONDUIT

The photograph at the left shows how PERMANENT SLOPE is accomplished — by means of a solid concrete foundation. The piping, on roller supports, is ready and easily accessible for welding and insulation. The assembly view below also shows the concrete foundation.

The installation at the lower left, partly completed, shows what Therm-O-Tile looks like when ready for back fill — a truly dependable conduit regardless of weather, water, or other conditions.

WRITE FOR BULLETIN 511. This bulletin, just recently published, gives complete information concerning Therm-O-Tile.

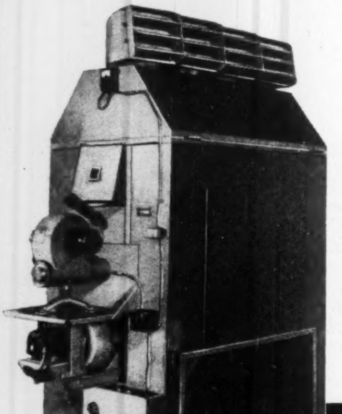
OUR ENGINEERS will gladly recommend, estimate cost, and furnish specifications on any underground pipe line project upon request.

JOHNS-MANVILLE. Therm-O-Tile is represented by Johns-Manville Technical Service Units in all principal cities.

H. W. PORTER & CO., INC.
822-H Frelinghuysen Avenue • Newark 5, N. J.
REID HAYDEN, INC.
BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.
Insulation Engineers & Contractors

EASY CONTROL

EASY CONTROL IS AN OUTSTANDING FEATURE OF THE OLSON HEATER. THE CONTROL PANEL BOX IS WITHIN SIGHT AND REACH OF ALL BURNER ADJUSTMENTS. IT IS A DUST TIGHT, DAMP PROOF PANEL BOX. THE THERMOSTATIC AND SAFETY CONTROLS OPERATE ON 110 VOLT CURRENT FROM THE TRANSFORMER IN THE CONTROL BOX.



Other than heating, Olson builds heaters for special requirements, such as make-up air, drying, oven, process and high temperature applications.

Olson

ARTHUR A. OLSON & CO.
Gas, Oil, Coal or Dual Gas and Oil
BROAD ST. · CANFIELD, OHIO

Write for complete information and data sheet showing horizontal and inverted models, stoker fired and duct units.

augurate a statistical reporting program through the offices of REMA. All manufacturers of mechanical dehumidifiers will be invited to participate in the monthly reporting of shipments to distributors by units and dollar value. Also, work will be started on the preparation of an industry standard which would constitute a yardstick in referring to ratings, performance, nomenclature, etc. A standards drafting committee was appointed at the meeting.

GEORGE D. POTTER, formerly general sales manager, *WOLVERINE TUBE DIV., CALUMET & HECLA CONSOLIDATED COPPER CO., INC.*, Detroit, has been appointed director of sales. Succeeding him as general sales manager is *JOHN M. DUMSER*, who has been his assistant. *L. G. FOX*, formerly manager of wholesaler sales, is now manager of sales service. *S. C. SEEKELL*, formerly in charge of the Grand Rapids sales office, succeeds Mr. Fox.

The new assistant advertising manager for *JAS. P. MARSH CORP.*, Skokie, Ill., is *FERDINAND PAULS*, who has been with the sales department for about 10 years.

SCHAIBLE CO., Cincinnati, has appointed *R. W. HYDE* as manager of the product research and development department. Formerly he was with the Bendix Aviation Corp. *M. M. GARVIN*, previously with Cincinnati Milling Machine Co., is now manager of the process research department.

GUY W. THAXTON, formerly regional power supply coordinator of the Defense Electric Power Administration, has been named power engineer in the division of construction and supply, *U. S. ATOMIC ENERGY COMMISSION*.

H. M. SOSSAMAN, formerly general sales manager, is now vice president in charge of commercial development, *QUAKER RUBBER CORP.*, Philadelphia.

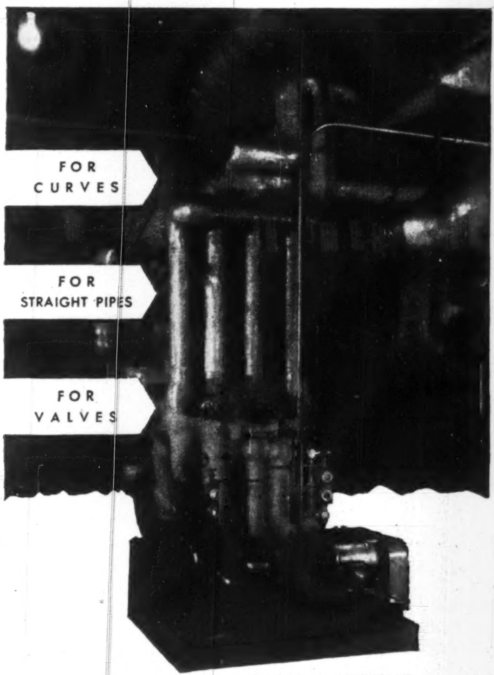
EDWARD W. HANSON, for 33 years an estimator and superintendent of construction for *SAUER, INC.*, Pittsburgh, has retired.

MYRON D. MILLER has been appointed full time secretary and safety code consultant of the *REFRIGERATION INDUSTRY SAFETY ADVISORY COMMITTEE*, with offices at National Electrical Manufacturers Association headquarters in New York. He succeeds the late *CYRUS W. MILLER*.

The newly elected president of the *ALDRICH CO.*, Wyoming, Ill., is *PHILIP M. STEPHENSON*, who has been vice president and general manager.

W. W. KOVALICK, formerly chief engineer, is now production manager of the Chicago plant of *INGERSOLL PRODUCTS DIV., BORG-WARNER CORP.* He succeeds *J. W. DEAN*, resigned. *H. T. BURKE*, formerly chief tool engineer, is now acting chief engineer.

HAROLD H. HEINECKE has been named assistant manager of the commercial research department, general machinery division, *ALLIS-CHALMERS MFG. CO.*, Milwaukee. Formerly he was manager of market research at Perfex Corp.



- LASTS A LIFETIME
- EASILY INSTALLED
- APPLIES WITHOUT WASTE

for Maximum Efficiency

SPECIFY ALL-HAIR

OZITE

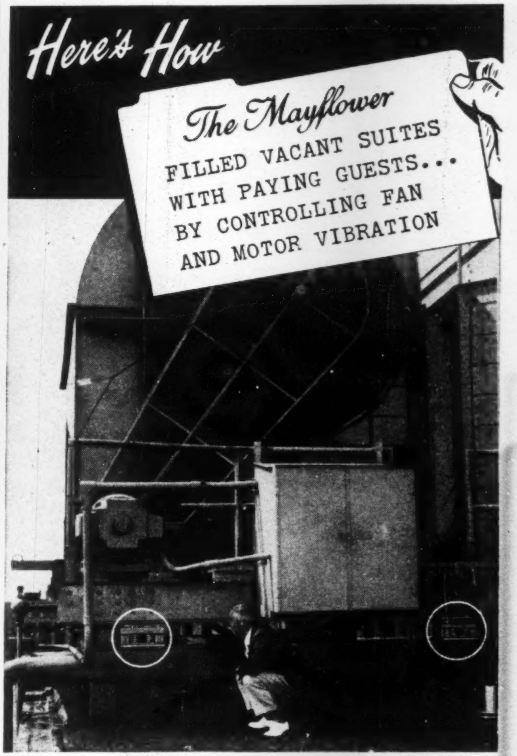
INSULATING FELT

OZITE All-Hair Felt has been the best insulation for the refrigeration industry for over half a century. Here's why —

. . . low conductivity provides efficient heat barrier . . . allows close temperature control . . . permits maximum capacity of refrigeration units . . . reduces power consumption . . . does not rot or pack down — resists fire.

For all of the facts about time-proven OZITE send for 4-page Bulletin No. 300.

AMERICAN HAIR & FELT COMPANY
Dept. C23, Merchandise Mart
Chicago 54, Illinois



13-Ton Fan and Motor on Roof of
Mayflower Hotel, Washington, D. C.

Vibration from this huge cooling tower fan and motor made it impossible to rent suites on the floor below. Even water standing in drinking glasses showed a decided side-to-side movement.

That's all changed now.

As an executive of The Mayflower recently wrote, "Thanks to the recent installation of Korfund Steel Spring Vibro-Isolators, complaints regarding vibration have ceased."

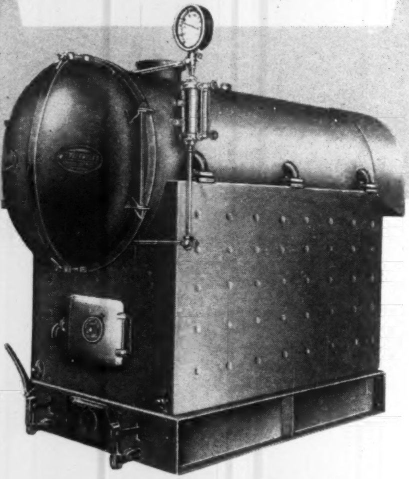
When installed on roofs and upper floors, large fans, high pressure systems (including the centrifugal compressors), and reciprocating compressors require special consideration. It costs surprisingly little to prevent serious vibration problems with Korfund Vibration Control. There are also low cost Korfund mountings for less critical installations such as centrifugal pumps, most ventilating fans, and for basement and factory installations.

The Selector Chart in Bulletin G-104 gives recommendations for isolation of most equipment for both critical and normal conditions. See Sweet's Architectural or Engineering Files, or write for your free copy today. We'll also submit specific recommendations, without obligation. Just contact us, or the Korfund representative you'll find in most principal cities. A half century of experience is at your disposal.

Representatives in Principal Cities

KORFUND VIBRATION CONTROL
SPRINGS RUBBER CORK

THE KORFUND COMPANY, INC.
48-01F Thirty Second Place • Long Island City 1, N. Y.



✓ COMPACT
✓ ECONOMICAL
✓ Engineered for Better Service

TITUSVILLE
"Compact" STEEL HEATING
BOILERS

✓ AUTOMATIC WELDING
—assures strong joints and seams
✓ AMPLE COMBUSTION AREA
—burns all fuels efficiently
✓ POSITIVE CIRCULATION
—with high velocity side circulators
✓ FULL WIDTH FLUE DOORS
—quick access to tubes
✓ MANY OTHER FEATURES

Write for the facts on this famous Titusville Boiler—Bulletin B-3000-B gives you detailed descriptions, specifications and dimensions, free on request.

THE TITUSVILLE IRON WORKS COMPANY
A division of Struthers Wells
Representatives in Principal Cities
TITUSVILLE, PENNSYLVANIA

JOHN W. SCHREIBER, a veteran of 42 years service with *ALUMINUM CO. OF AMERICA*, Pittsburgh, has retired as chief construction engineer. He will serve until July 1 as a special consultant on construction. Succeeding him is *L. B. KUHNS*, who has been general superintendent of construction.

J. S. RYAN, formerly manager of inventory control, has been named purchasing agent for *HAJOCA CORP.*, Philadelphia, succeeding *V. A. HAZZARD*, who has resigned.

H. S. GARRETT and *J. V. CHRISTMAN* have been appointed assistants to the director of purchases, *WAGNER ELECTRIC CORP.*, St. Louis. *M. W. COX* is the new supervising buyer, and he will be assisted by *J. E. ROTH*.

. . . IN THE TERRITORIES

For *THE LUNKENHEIMER CO.*, Cincinnati—general reorganization of sales territories and executive appointments. Sales managers: new eastern division, *MELVIN W. PAULY*, formerly manager, New York branch; central division, *HAROLD H. LAYRITZ*, with the company for 31 years; western division, *CHARLES W. BURRAGE*, formerly manager of sales engineering. New district managers: *R. J. SARDIECK*, eastern division, headquarters at Philadelphia; *E. R. TIEBERMAN*, central division, headquarters at Dallas; *C. B. ROSSER, JR.*, western division, headquarters at Los Angeles.

For *AMERICAN DISTRICT STEAM CO., INC.*, North Tonawanda, N.Y.—a branch office in Detroit, at 401 Architects Bldg., 415 Brainard St. New district manager, *HARRY P. OSGOOD*, who has been associated with the Fulton Sylphon Co.

For *KAYLO DIV., OWENS-ILLINOIS GLASS CO.*, Toledo—new organization of insulation sales force, with three regional supervisors and five new branch managers. Supervising southwestern insulation sales, *THOMAS F. SEARS*, headquarters in Houston; midwest sales, *LEWIS F. SCOTT*, headquarters in Chicago; eastern sales, *ROBERT L. LONG*, headquarters in Toledo. New branch managers are *ARTHUR B. PIKE*, Boston; *CARL RAMIEN*, Philadelphia (territory expanded to include the Washington, D.C. area); *ROBERT L. MAJOR*, Pittsburgh; *IKE KEITH*, St. Louis; and *JAMES D. HAILEY*, Cleveland.

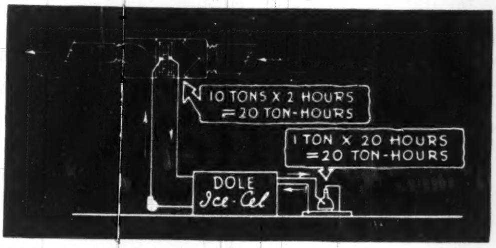
For *MAID-O'-MIST, INC.*, Chicago—representative for the northern Ohio territory, *THE MUSSUN EQUIPMENT CO.*, 958 Hanna Bldg., Cleveland 15.

For *TUBE TURNS, INC.*, Louisville, Ky.—*LINCOLN D. HALL*, district manager, mid-continent territory, with headquarters in the Wright Bldg., Tulsa. Formerly west coast sales manager for Taylor Forge & Pipe Works, he succeeds *ROBERT S. TYLER, JR.*, who resigned to join the new Tyler-Dawson Supply Co., Tulsa.

For *AIR REDUCTION MAGNOLIA CO.*, division of *AIR REDUCTION CO., INC.*, New York—*JOHN LUND*,

DOLE *Ice-Cels* SAVE MONEY 2 WAYS

ON PEAK AIR CONDITIONING LOADS OF SHORT DURATION



The Ice-Cel (like your car battery which is charged at a low rate to handle heavy starting loads), is charged slowly to provide heavy refrigeration loads for a short period of time.

DOC DOLECO says — 25 years of specialization in plate refrigeration have made DOLE the leader, often imitated but never equalled.

In air conditioning installations where a heavy operating load is required for a relatively short period of time—such as in auditoriums, churches, mortuaries, lodge halls, cafeterias, stores and offices—DOLE Ice-Cels save money both on the original investment and in operating costs. A smaller-sized compressor used with Ice-Cels requires less current with a lower demand rate.

DOLE Ice-Cel refrigeration is extremely flexible both in its application to air conditioning jobs and in operating schedules. Investigate DOLE Ice-Cels for those air conditioning jobs in your territory. Arm yourself with literature and prices, free for the asking.

DOLE Vacuum COLD PLATES
Maximum Refrigeration Efficiency

DOLE REFRIGERATING COMPANY

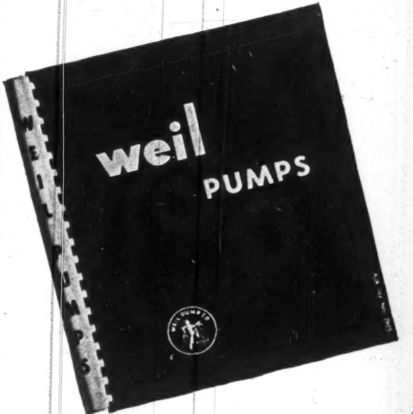
5918 N. PULASKI RD., CHICAGO 30, ILL.
103 Park Ave., New York 17

In Canada: Dole Refrigerating Products Limited, 44 Elgin Street, Brantford, Ontario.

NOW! A NEW TYPE OF PUMP CATALOG. DESIGNED TO MAKE PUMP SELECTIONS QUICK AND SIMPLE.

with

- ENGINEERING DATA
- SEWAGE EJECTORS
- DRAINAGE PUMPS
- WATER SUPPLY SYSTEMS
- WELL PUMPS
- CIRCULATING PUMPS
- HOT WATER CIRCULATING PUMPS
- CONDENSATION RETURN PUMPS
- CONDENSER WATER PUMPS



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weil PUMP CO.

1535 FREMONT ST. CHICAGO 22, ILL.

IN STOCK for Your Convenience

AURORA
CLOSE-COUPLED
Package

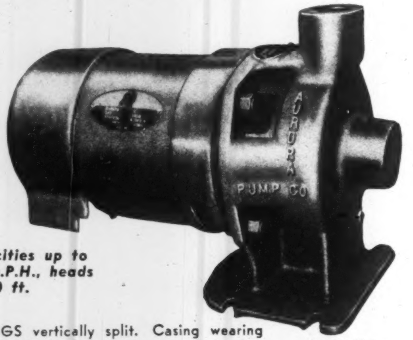
AIR CONDITIONING PUMPS

They have EVERYTHING!

☑ LOW COST
☑ SMOOTH, QUIET
☑ DEPENDABLE
☑ LONG LIVED
☑ MECHANICAL SEAL
☑ DISASSEMBLY is QUICK and SIMPLE*

for
EVAPORATOR
COOLING
TOWERS
•
AIR
CONDITIONING
UNITS
•
also for
GENERAL
SERVICE

Air conditioning contractors as well as manufacturers of air conditioning equipment will welcome these notable close-coupled package pumps. Mechanical seal requires no packing or maintenance. *Pump may be disassembled without disturbing discharge connections or hold down bolts. Sturdy, lasting and efficient.



Capacities up to 150 G.P.H., heads to 100 ft.

Aurora Type JMC Pump — Close-Coupled

CASINGS vertically split. Casing wearing ring standard.

MECHANICAL SEAL is standard on all sizes and located in packing cover.

IMPELLER is balanced, of enclosed type, high grade bronze.

MOTOR — NEMA specifications, Stainless Steel Shaft on JMC — for all circuits and various enclosures.

BALL BEARINGS — on JMC built into motor.

OTHER AURORA AIR CONDITIONING UNITS

We are also in a position to supply various sizes of air conditioning pumps in V-Belt drive, and flexible coupling drive. Our large type G.M.C. Close-Coupled Pumps can be furnished up to 800 G.P.M. and heads to 200 ft.

Complete Information on Request
DISTRIBUTORS IN PRINCIPAL CITIES

AURORA *Always* PUMPS

AURORA PUMP COMPANY
80 Loucks St., Aurora, Illinois

formerly assistant manager, now district manager at Shreveport, La., succeeding the late *HEBER T. WADLEY.*

For *ACME INDUSTRIES, INC.*, Jackson, Mich.—two new branches, one at 52 First St., Cambridge, Mass., the other at 402 Forest Ave., Portland, Me. The Cambridge office, headed by *FRED W. SMITH*, formerly president, Baker Refrigeration Corp., supplements the service of the regular New England agency in Springfield, Mass., which has been representing the company for over ten years. Mr. Smith has entered into partnership with that agency. He will be assisted by *CHESTER A. GARLAND*, formerly his assistant at Baker.

For *REMINGTON AIR CONDITIONING DIV., REMINGTON CORP.*, Auburn, N.Y.—*WESTINGHOUSE ELECTRIC SUPPLY CO.*, 324 College St., Charlotte 1, N.C., is distributor for room air conditioners. Supply company district offices under Charlotte are at 209 Walker Ave., Greensboro, N.C.; 319 West Martin St., Raleigh, N.C.; 915 Lady St., Columbia, S.C.; and 226 Pendleton St., Greenville, S.C.

For *UNITED STATES AIR CONDITIONING CORP.*, Minneapolis—*WILLIAM F. APPLEGARTH*, representative, Atlanta, Ga., area. For four years he has been director, Industrial Trades Institute in refrigeration, heating and air conditioning training.

For *L. J. MUELLER FURNACE CO.*, Milwaukee—*HARRY M. HARRIS*, sales representative for parts of Missouri, Nebraska, Iowa, Kansas and Oklahoma, with headquarters in Marion, Kan.

For *THE YOUNGSTOWN SHEET AND TUBE CO.*, Youngstown, Ohio—new district sales manager, Cleveland office, *JAMES A. HALE*, succeeding *F. A. OLMSTEAD* who died recently.

For *BRUNNER MFG. CO.*, Utica — *J. W. THOMAS*, sales manager for the past five years, is now New York district sales manager. He replaces *G. W. MATHEWS*, who has retired, but who retains his position as a member of the board of directors.

For *FAIRBANKS, MORSE & CO.*, Chicago—five new branch managers: *MILO C. ROY*, formerly manager at Omaha, now manager at Chicago; *J. W. WRIGHT*, formerly manager, Diesel Sales Div., succeeds him at Omaha; *W. B. WYLLY*, former manager of Houston subbranch, now manager at Atlanta; *L. A. WEOM*, former St. Louis manager, now transferred to St. Paul to succeed *A. C. THOMPSON*, retired after 45 years service; *CLIFFORD J. SCHROEER*, previously diesel department manager at St. Louis, succeeds Mr. Weom as manager.

For *BROWN PRODUCTS CO.*, Forest Hills, N.Y.—*OLIVER & BRINK INC.*, representative for Maine, New Hampshire, Massachusetts and Rhode Island.

For *PITTSBURGH LECTRODRYER CORP.*, Pittsburgh—a new representative for central and western New York, *C. R. WELLMON*, Erie, Pa.

Lane Bryant

. . . quiets noisy cooling tower

For over 51 years the name Lane Bryant has been a byword for progressive merchandising and good public relations in its field.

When their cooling tower installation caused objectionable noise it is not surprising that management took immediate steps to eliminate the trouble.

Nor is it surprising that INDUSTRIAL SOUND CONTROL was called upon for a solution — because ISC was the originator of industrial soundproofing.

ISC installations, from cells for testing the most powerful jet engines to soundproofing a small compressor, have been job-proven over the years.

Write *today* for ISC's free booklet, "Sound Facts."

***Mid-western Distributor:* Midwest Industrial Sound Control, Inc.**
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Industrial Sound Control, Inc.
45 GRANBY STREET HARTFORD, CONN.
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Put your overweight fuel bill on a reducing diet

Save as much as 20 to 30% on Fuel Costs... burn Heavier, High-Heat, Low-Cost No. 5 Oil

Because it efficiently uses the heavier, high-heat content, less expensive commercial No. 5 fuel oils, the Cleaver-Brooks HEV-E-OIL Burner provides substantial savings in fuel costs — cuts costs as much as 20% to 30%. Hundreds of satisfied users report exceptional operating economy with the HEV-E-OIL burner — saving fuel costs two ways —on lower cost per gallon and total amount of fuel used.

If you are burning more than 6,000 gals. of oil or more than 45 tons of coal per year, get complete information on the HEV-E-OIL Burner — the product of a nationally known manufacturer of oil-combustion equipment. Available in five sizes — 1 to 60 gals. per hour capacity ranges. Send today for latest descriptive bulletin No. AD-102.

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HEV-E-OIL Burner Division
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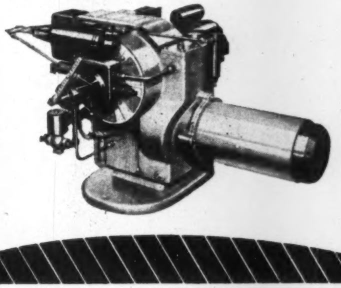
"The Burner Designed to Save You Money"

For Commercial, Industrial, and Institutional Installations

- Burns low-cost, high-heat No. 5 oil
- Automatic all-electric ignition — no expensive gas-pilots required.
- All air supplied by large forced draft fan
- Low fire starting
- Full-flame modulation — set exactly for size of boiler or furnace
- Automatic pressure lubrication



NEW BOOKS & REPORTS

Data on Practical Industrial Ventilation

The second edition of *Industrial Ventilation* has been published by the American Conference of Governmental Industrial Hygienists. It is a manual of recommended practices for those interested in the design and installation of industrial exhaust systems. This edition offers no basic change over the first. It covers general principles of ventilation, dilution and comfort ventilation, hood design, specific operations, duct design, make-up and recirculated air, construction specifications, testing of ventilation systems, fans and air cleaning devices. The text is supplemented by more than 500 illustrations.

This book is available from the conference's Committee on Industrial Ventilation, P.O. Box 453, Lansing 2, Mich., at $3.00 a copy.

Accident Prevention Manual

As another step in its safety program, The Associated General Contractors of America has published 14 pocket-sized reprints of some sections of its *Manual of Accident Prevention in Construction*, which was revised in 1949, and is ASA approved. Each reprint contains from one to six sections covering various operations encountered in construction projects. Of special interest are Booklet F, with recommendations for arc welding, gas welding and cutting, and explosive gases and liquids; Booklet L, covering boilers and unfired pressure vessels; and Booklet M, which includes information on laying pipe lines.

The reprints are available from the AGC, Munsey Bldg., Washington 4, D.C., or from most chapter and branch offices, at 10 cents a copy (with progressively reduced prices as quantity ordered increases).

Thermal Insulation Symposium

The symposium on thermal insulating materials, which was presented at the Spring meeting of the American Society for Testing Materials, is now available as a special publication (STP No. 119). In two of the papers, H. E. Robinson and T. W. Watson, National Bureau of Standards, and C. F. Gilbo, Armstrong Cork Co., discuss the guarded hot plate method of determining thermal conductivity. Concepts of water vapor migration and their application to frame walls are discussed by F. A. Joy, Pennsylvania State College. Surface emittance (methods for its measurement) and specific heat are covered in the remaining two papers, by L. P. Herrington and N. H. Spear, both of the John B. Pierce Foundation.

The publication (64 pages) is available from the Society, 1916 Race St., Philadelphia 3, at $1.50 a copy ($1.15 for members).

Measuring Humidity and Testing Hygrometers

For some applications there exists at present no satisfactory method for the measurement of the relative or absolute humidity of gases, and available information on methods and instruments for measuring humidity is scattered. *Methods of Measuring Humidity and Testing Hygrometers*, by Arnold Wexler and W. G. Brombacher,

Here's where... and why... to specify **Binks Type H Towers**

The diagram shows a typical arrangement for a natural draft cooling tower as used in a small capacity refrigeration and air-conditioning system.

A Binks Type H tower offers exceptional *cooling performance* due to correct louver spacing and balanced spray system. Binks non-clogging ROTOJET spray nozzles produce maximum heat dissipation.

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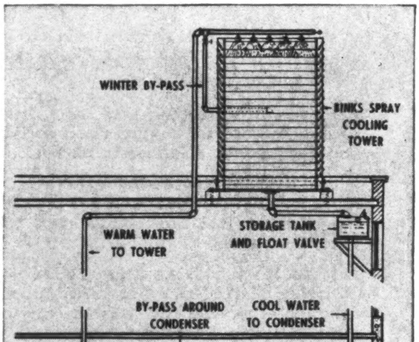

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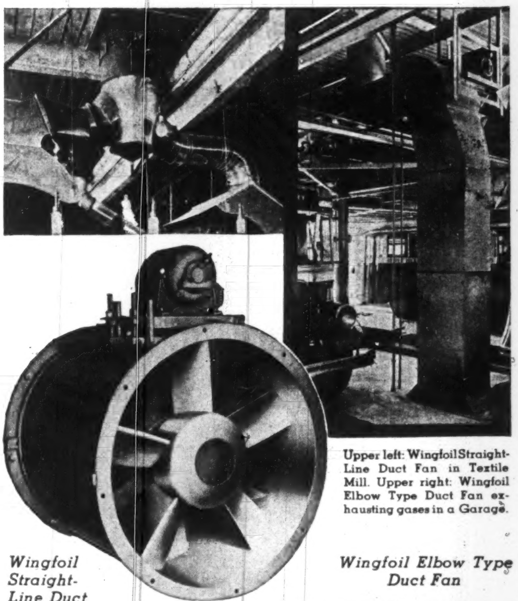
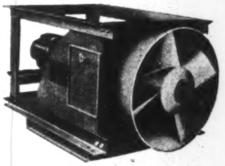


Upper left: Wingfoil Straight-Line Duct Fan in Textile Mill. Upper right: Wingfoil Elbow Type Duct Fan exhausting gases in a Garage.

Wingfoil Straight-Line Duct Fan

Wingfoil Elbow Type Duct Fan



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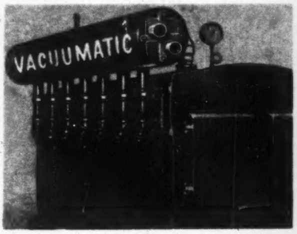

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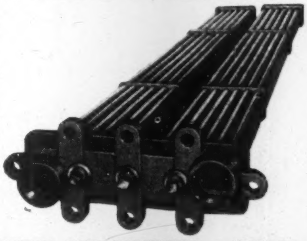

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fact 1 Although ventilators have long been selected primarily on the basis of capacity ratings, those ratings usually are based on *horizontal* wind tests only. *In actual use ventilators must perform with winds blowing at* ANY *angle.*

fact 2 Capacity ratings of most ventilators are not certified. Performance does not equal ratings claimed in some cases.

fact 3 Breidert Air-X-Hausters are the *pioneer* ventilators with published capacity ratings based on tests* made with wind blowing in *all* directions, as shown below.

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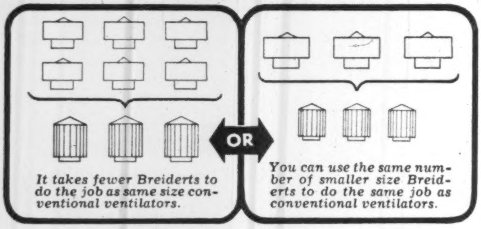
fact 4 The Breidert delivers better results at minimum cost, as indicated below.



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National Bureau of Standards, is designed to answer, in both text and appended references, a large number of questions in this area. It reviews methods for measuring water vapor content of air and other gases and for producing and controlling atmospheres of known humidity for hygrometer testing and calibration and for general research. It discusses such techniques as psychrometry, mechanical hygrometry, dewpoint measurement, electric hygrometry, gravimetric hygrometry, thermal conductivity, index of refraction, etc.

The paper, Circular 512 (18 pages) is available from the Government Printing Office, Washington 25, D.C., at 15 cents a copy.

Effect of Window Design on Air Flow Through Buildings

The customary approach to the design of a window is from the standpoint of mechanical efficiency, weatherproofing, installation adaptation, strength, etc. However, a recent research report issued by the Texas Engineering Experiment Station (Texas A and M College System) concludes that more design consideration can, and should be given to the air control characteristics of a window.

Research Report 33, *Air Flow Through Conventional Window Openings*, describes air flow tests made for a number of different types of conventional windows (single hung, double hung, casement, folding, projected, awning, horizontal pivot, etc.) No general recommendations could result, since there are too many variables (design and type of building, climate, geographical locations, etc.) to allow one set of standards to govern the type, size, quantity and placement of windows. It is possible however, according to the report, to choose proper window types for specific buildings, with knowledge of the air control of each window type, and using smoke tests with a model of the simulated conditions. Such model tests were found to be feasible, since variations in air speeds did not seem to affect air patterns. The report also concluded that the placement of outlet openings does not affect the air pattern made through the window, nor the room's overall air pattern.

Copies of the report may be obtained from the experiment station, College Station, Tex.

New Value for Absolute Viscosity of Water at 20 C

A determination of the absolute viscosity of water at 20 C with greater accuracy than prevously achieved has been completed by J. F. Swindells of the National Bureau of Standards. The new value is 0.01002 poise (dyne-seconds per square cm) as compared with 0.01005 poise which has been accepted to the present time. The absolute viscosity of water serves almost universally as the standard to which the viscosities of all other liquids are referred. Beginning July 1, 1952, the Bureau will use the new value as the primary standard for calibrating viscometers.

Details of the study can be found in the paper, *The Absolute Viscosity of Water at 20 C*, by J. F. Swindells, J. R. Coe, and T. B. Godfrey, Journal of Research, National Bureau of Standards, Vol. 48 (1952), RP 2279.

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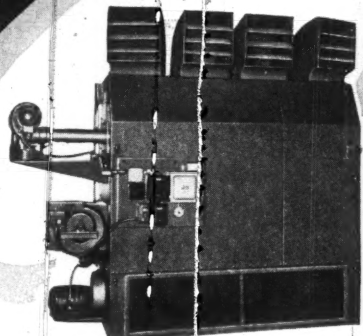

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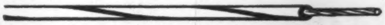

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Incentive in Industry

How incentive systems in industry can aid in the development of individual skills, and bring about closer cooperation between labor and management, is the main theme of *Incentive Management*, by James F. Lincoln, president, The Lincoln Electric Co. There is discussion of what constitutes incentive, the philosophy behind incentive systems, and the concrete problems of how to start such systems in industry. Also covered are the role of piecework, and of unions, in incentive management.

This 280 page book is available from the company, 22801 St. Clair Ave., Cleveland 17, at $1.00 a copy, postpaid, in the U.S., $1.50, postage prepaid, elsewhere.

Machine Elements and Assembled Machinery for Air Conditioning and Related Fields

The Engineer's Illustrated Thesaurus, by Herbert Herkimer, is designed to aid the engineer, designer, draftsman and manufacturer in selecting the machine parts or equipment suitable for specific applications. Each type of machine part is illustrated and identified (there are 8000 illustrations), and where necessary, operating details are given. An index is also provided. The book covers transmission of liquids and gases; combustion; prime movers; heating, cooling and air conditioning, etc.

This 572 page book is available from the publisher, The Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, at $6.00 a copy.

Celanese Corp. Uses 6420 Horsepower of Frick Refrigeration

Fourteen Frick refrigerating machines are in operation at the Amcelle plant of Celanese Corporation of America, near Cumberland, Md., makers of chemical yarns. Most of these ammonia compressors have been in use since 1929. The motors driving the new vertical machines, shown in the foreground, are each of 1250 hp.

This is a large-scale example of the dependability and economy of Frick ammonia refrigeration. Power requirements, when operating in summer weather on air conditioning loads, are only 0.70 hp. per ton of refrigeration.

The really important jobs, whether for air conditioning, ice making, or other commercial cooling work, call for FRICK refrigeration.

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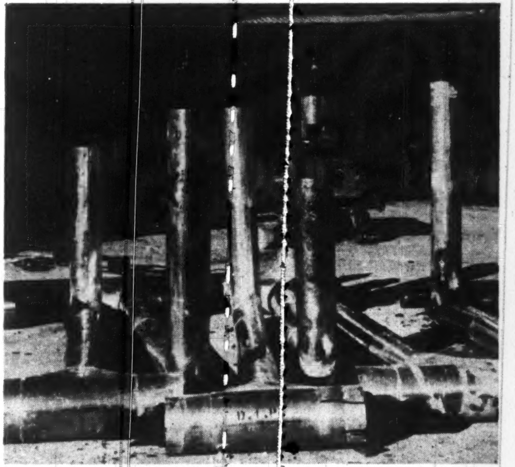

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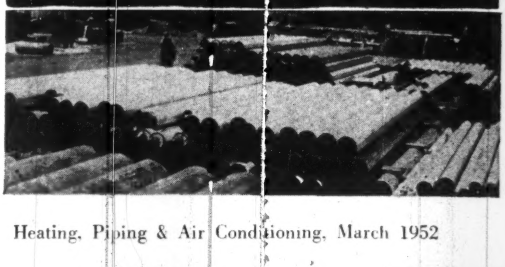

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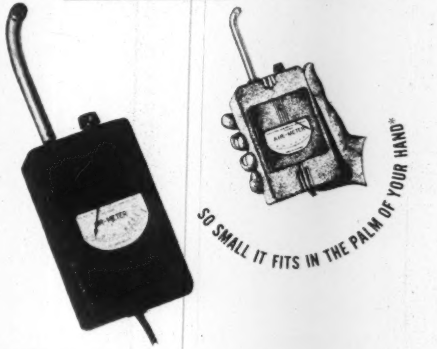

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MEETINGS & CONVENTIONS

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 919 Milam Bldg., Houston, Tex.—1952 annual conference and exhibition, headquarters, Buccaneer Hotel, meeting rooms and exhibit, Galveston Pleasure Pier, March 10 to 14, Galveston. Symposiums will cover corrosion principles, oil and gas production industry, chemical industry, refinery industry, electrical and communication industry, protective coating industry, oil and gas transportation and storage industry and marine industry. Round tables will be on pipe line and underground corrosion and general corrosion.

IBR SCHOOL OF MODERN HEATING—March 11 to 13, Iowa State College, Ames; March 18 to 20, Indianapolis; March 25 to 27, Louisville, Ky.; April 1 to 3, Richmond, Va. Sponsored by The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17. The school is a three day course providing instruction in the design and installation of hot water and steam heating systems. A complete list of meetings scheduled through June is available from the institute.

CHICAGO INTERNATIONAL TRADE FAIR—March 22 to April 6, Navy Pier, Chicago. For further information contact Chicago International Trade Fair, Inc., Merchandise Mart, Chicago 54.

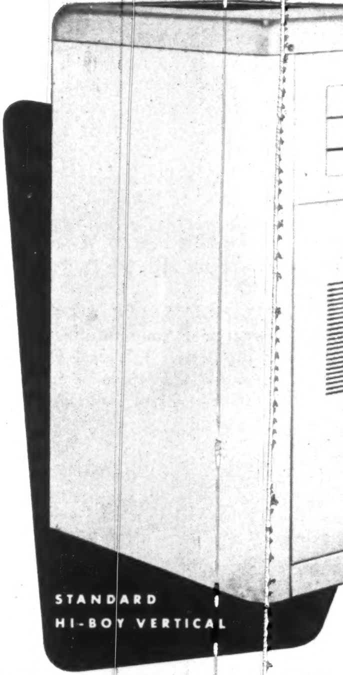
REFRIGERATION EQUIPMENT MANUFACTURERS ASSOCIATION, 1346 Connecticut Ave., N. W., Washington 6, D.C.—Annual meeting, March 26 to 28, The Greenbrier, White Sulphur Springs, W. Va.

FIRST ANNUAL AMERICAN POWER CONFERENCE—March 26 to 28, Hotel Sherman, Chicago. Sponsored by the Illinois Institute of Technology, Technology Center, Chicago 16. Formerly called the Midwest Power Conference, it has been renamed since the previous 13 meetings proved to be wider in scope and character than the name implied. The same group of schools and societies will participate, with the addition of The Edison Association of Illuminating Companies, and the Edison Electric Institute.

OIL-HEAT INSTITUTE OF AMERICA, INC., 6 E. 39th St., New York 16—29th anniversary exhibition of the automatic oil-heat industry, April 14 to 18, Commercial Museum, Philadelphia. To be held concurrently with the annual convention, which will be headquartered at the Benjamin Franklin Hotel.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, 1941 Grand Central Terminal, New York 17—Annual convention and exposition, May 1 to 3, Hotel New Yorker, New York. For information on exhibition space, write A. A. Lorie, Frederic R. Harris, Inc., 27 William St., New York 5.

1952 INTERNATIONAL FOUNDRY CONGRESS AND SHOW—May 1 to 7, Convention Hall, Atlantic City. Host this year, the American Foundrymen's Society, 616 S.



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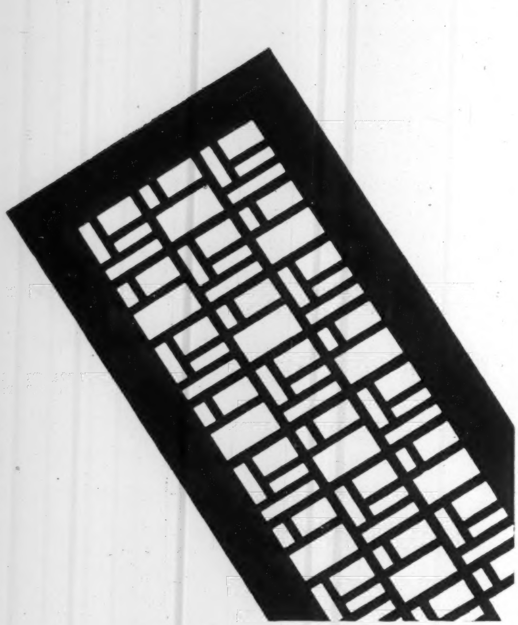

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Each design can be furnished in a wide range of overall dimensions, bar sizes, number of perforations and size of perforations. Made in accurate sizes from heavy gauge metals, with clean-cut perforations, Hendrick Grilles have no burrs or other imperfections.

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Michigan Ave., Chicago 5. The congresses are scheduled by the International Committee of Foundry Technical Associations, representing 12 countries. There will be a session on safety and hygiene and air pollution (non-ferrous), 4:00 p.m., May 3; on safety and hygiene, 10:00 a.m., May 5; and on safety and hygiene and air pollution (ferrous), 2:00 p.m., May 5.

SHEET METAL CONTRACTOR'S NATIONAL ASSOCIATION, 170 Division St., Elgin, Ill.—Annual convention, May 12 to 14, Rochester, N.Y. For further information, contact publicity committee chairman, Irving G. Spalty, 546 Jefferson Ave., Rochester 11.

INTERNATIONAL CHURCHMAN'S EXPOSITION—May 19 to 24, Chicago International Amphitheatre. Exposition managers, M. W. Hinson and J. Vancil, 19 S. LaSalle St., Chicago 3. Purpose of exposition, to aid in the planning, construction, maintenance and more effective use of church property.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—Next meeting, June 1 to 4, Biltmore Hotel, Atlanta. 38th annual meeting, November 30 to December 3, Hotel Commodore, New York.

NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6—43rd annual meeting, June 3 to 6, Skytop Club, Skytop, Pa.

HEATING, PIPING & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, Suite 1401, Rockefeller Center, 1250 Avenue of the Americas, New York 20 — 63rd annual convention, June 10 to 13, Hotel Statler, Boston.

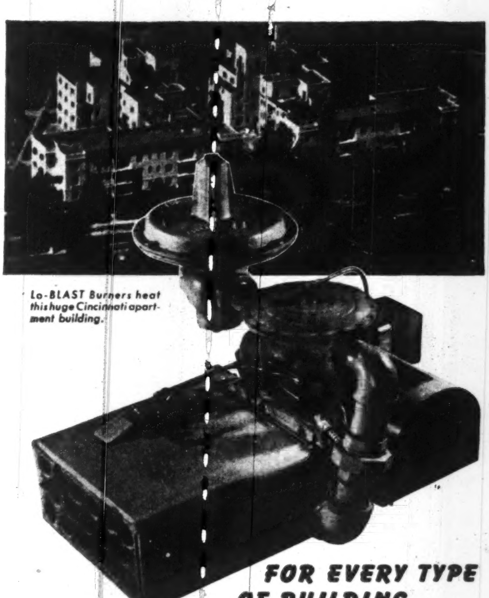
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13—Semi-annual meeting, June 16 to 18, The Essex and Sussex, Spring Lake, N.J.

STOKER MANUFACTURERS' ASSOCIATION, 307 N. Michigan Ave., Chicago 1—1952 annual meeting, June 23 and 24, South Shore Inn, Lake Wawasee, near Syracuse, Ind. There will be committee meetings, June 22.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—50th anniversary meeting, June 23 to 27, Hotels Statler and New Yorker, New York.

INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12. National Instrument Conference and Exhibit, September 8 to 12, Cleveland.

11th INTERNATIONAL HEATING & VENTILATING EXPOSITION — THE AIR CONDITIONING EXPOSITION — January 26 to 30, 1953, International Amphitheatre, Chicago. Held under the auspices of The American Society of Heating and Ventilating Engineers. Address inquiries to the exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17.



Lo-BLAST Burners heat this huge Cincinnati apartment building.

LO-BLAST

IS THE LOW-COST WAY TO HEAT WITH GAS

Every dollar trimmed from operating expense shows up on the profit side of the ledger. That's why fuel-saving Lo-BLAST Power Gas Conversion Burners are the sensible selection for buildings which must produce income . . . or for home owners concerned with keeping living costs down.

Lo-BLAST operating cost averages 10% less

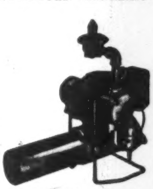
The Lo-BLAST principle of combustion utilizes an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air. Hence operation is always independent of natural draft conditions—makes the Lo-BLAST ideal for down-draft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to the crown sheet as well as side walls. There's no combustion roar—the flame is soft and *quiet!*

High efficiency on intermittent operation

Lo-BLAST Burners show only a small drop in over-all efficiency when changing from constant to intermittent operation. This is the reason for Lo-BLAST fuel economy, since intermittent operation is the normal condition for any heating plant.

Factory-tested on gas, shipped completely assembled

Installation and servicing are easy *because there's nothing in the firebox but the fire!* All units have standard controls with positive acting pilot and blower safetys.



Lo-BLAST Economite
Residential size—70,000 to 300,000 BTU—with all the fuel-saving features of the standard Lo-BLAST.

Capacities from 70,000 to 20,000,000 BTU input. Write for engineering data.

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

IF IT'S KRITZER IT'S RIGHT, SIR!!
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KRITZER CONCEALED "FIN-TUBE" RADIANT COILS
KRITZER BASEBOARD CONVECTOR
KRITZER "STANDARD" RADIANT BASEBOARD
KRITZER COMMERCIAL "FIN-PIPE" COILS

KRITZER REASONING HAS HAD 39 YEARS OF SEASONING

Kritzer entered the heat transfer field in 1912 and this long experience is reflected in the ability of Kritzer Radiant Coils to heat anything, anywhere—yet remain economical, easier to install, more efficient in use, and absolutely true to their ratings. This last is backed by Kritzer's exclusive CERTIFIED RATINGS—ratings based on and proven by actual operation in the laboratory and the field.

Put this experience to work for you. Write for complete information. Then specify Kritzer Radiant Coils for your next job and discover how *Kritzer and you* can make your every heating job a profitable success.

See your Jobber for Kritzer Radiant Coils.

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Here's Your First Step on the Road to Profits with Kritzer Radiant Heating.

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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 223. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air Conditioners

HPAC 101—Promotional package covering 1952 line of window type and console model air conditioners — Remington Air Conditioning Div., Remington Corp., Auburn, N.Y. It includes complete specification sheets on the various models, a folder illustrating each basic model, material for direct mail campaigns, sample publicity releases, etc.

Air Mover

HPAC 102—Bulletin DP-5 describes the "M.S.A.-Lamb" air mover for moving large volumes of air in situations requiring intermittent or emergency ventilation (as in plants, mines, etc.) — Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8. The instrument is portable, and employs compressed air or steam for operation. The bulletin gives details of various applications in which the device is used to remove air contaminants from confined areas, or to introduce fresh air for safer ventilation or rapid cooling.

Alloy Welding Fittings

HPAC 103—Bulletin covers "Key-Kast" alloy welding fittings, which incorporate a new design of greater wall thickness throughout and extra thickness at critical areas (for allowance against erosion and corrosion) — Key Co., 2617 McCasland, East St. Louis, Ill.

Applications of Wrought Iron

HPAC 104—Illustrated booklet, *Proof by Performance*, describes in a non-technical manner a number of installations (piping, construction, etc.) in which wrought iron gave service over long periods of time — A. M. Byers Co., Clark Bldg., Pittsburgh 22.

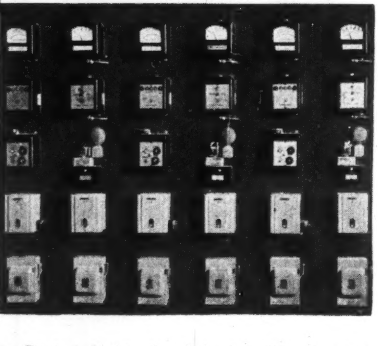
Area Flow Meters with New Metering Floats

HPAC 105—Bulletin covers "Flowrator" area flow meters with new "Predictable" metering float designed to provide flexibility of use — Fischer & Porter Co., 5580 County Line Rd., Hatboro, Pa. The new standardization program is intended to provide lower prices and stock deliveries. Flow factors can now be changed easily to allow the application of any one meter to different services, the company states. Various types of meters and sight flow indicators are covered.

Ceiling Air Diffusers

HPAC 106—Booklet (eight pages) gives data on controlled effective area, maximum permissible neck velocities, construction, etc., of "Flexiflo" adjustable ceiling air diffusers — Universal Diffuser Corp., 890 Whittier St., New York 59. Selection data also is included.

Military base equipped with Perfex instruments

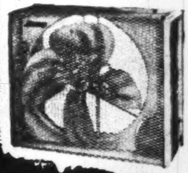


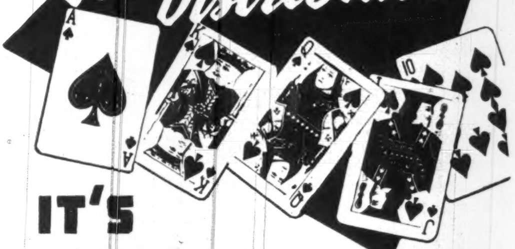
Panelboard below, with three sets of Perfex instruments, automatically controls three boilers.

Bases throughout the nation are now stretching fuel supplies and helping conserve our natural resources with Perfex Industrial Instruments. O'Hare Field is one of the most recent military installations. Send for latest bulletin on money-saving controls for gas, oil, or stoker-firing.

PERFEX
INDUSTRIAL INSTRUMENTS

PERFEX CORPORATION, MILWAUKEE, WISCONSIN • In Canada, Perfex Controls, Ltd., Guelph & Toronto 1 *a* **SQUARE DEAL FOR** *Fan Distributors*



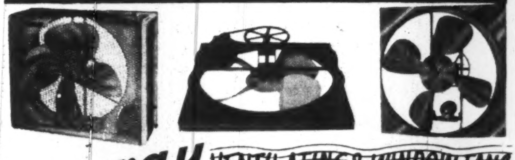


IT'S IMPOSSIBLE TO LOSE MONEY ON A *Murray* **FRANCHISE**

GUARANTEED PROFITS

Report unsold fans inventory to Murray after season — for FULL CASH CREDIT. No seasonal tie-up of fluid capital. What you sell, you profit on — what you don't sell, simply report and receive check. You can't lose.

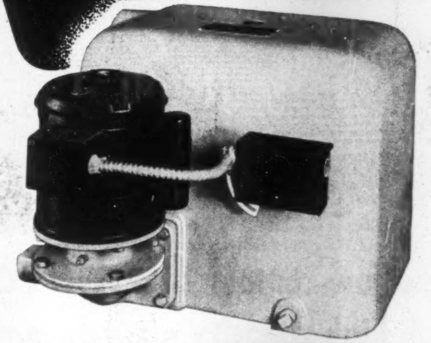
NO LOSS *On Inventory Carry Over!*



Murray ~~VENTILATING & WINDOW FANS~~

H. C. BIGLIN CO., INC. EXCLUSIVE SALES AGENTS
177 Harris St., N. W., Atlanta 3, Ga.

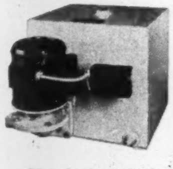
Sterlco **CONDENSATION PUMPS**



Proving **THEMSELVES** *in* **INSTALLATION** *after* **INSTALLATION**

Time after time, Sterlco Condensation Pumps have proven they can do a better job — and there are many reasons why. Take, for instance, the Sterlco 4200 Series Condensation Pump. It is designed to do one job, and do it outstandingly well. Rated conservatively, the 4200 can actually safely deliver its full rated output continuously for long periods — and its many exclusive features cannot be found in much higher priced pumps. Yes, it's no wonder Sterlco *always* does a better job.

- **LONG WEARING Carbon-Type ROTARY SEAL**
- **LARGE CAPACITY TANK**
- **COMPACT, NEAT APPEARANCE**
- **EASY ACCESSIBILITY OF PARTS**



New Sterlco 4100 Series for jobs where steel tank is preferred. Same features as 4200.

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All STERLCO products are distributed through leading heating and plumbing wholesalers.

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PRODUCTS
Condensation and vacuum pumps
Heating specialties
Temperature controls

Solve toughest large scale ventilation problems

The low-contour Airmover for high-capacity air movement

You can have all the ventilation you want—at economical cost. Airmover exhausts large quantities of heat, smoke or fumes rapidly through its short-air-travel, low-air-friction construction. It's only 32 inches high, built in rectangular units that can be placed on any type roof.

Install any number of units in continuous runs. You literally can "open your roof to the sky", yet have full weather protection. Single units or shorter runs prove effective over specific "hot spots". The low contour and unusual flexibility have made Airmover the popular industrial ventilator. Write for Folder 326F.

The Swartwout Line includes a variety of gravity and powered ventilators.

18511 Euclid Avenue, Cleveland 12, Ohio
The Swartwout Co.
Roof Ventilators and Ventilating Louvers
POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

Clamps, Straps and Hangers

HPAC 107—Catalog describes and illustrates line of clamps, straps, and hangers for cable, tubing, pipe, conduit, etc., from 1/8 to 6 in. OD — Victor Specialties, 775 Main St., New Rochelle, N.Y.

Control Thermometers

HPAC 108—Specification sheet 609 describes the "Electr-O-Vane" control thermometer which has snap action electronic control — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Dehumidification

HPAC 109—Two bulletins, *The Moisture in the Atmosphere, Its Nature, Behavior and Measurement,* and *Vapor Barriers for Dehumidification* offer information for the engineer on the complex nature of moisture and its control — Pittsburgh Lectrodryer Corp., 327 32nd St., Pittsburgh. They were prepared by Professors Elmer E. Queer and E. R. McLaughlin, State College, Pa. The second booklet contains tables showing the permeance of many types of building materials, the regain of hygroscopic materials, and data on vapor transfer, load analysis and machine operation analysis in typical warehouse buildings.

Direct-Connected Synchronous Motors for Reciprocating Compressors

HPAC 110—Publication 1200-TEC-1111 is a reprint of a paper on application of direct-connected synchronous motors to reciprocating compressors, which was presented at a recent AIEE (New York section) motor selection and application course — Electric Machinery Mfg. Co., 1331 Tyler St., N.E., Minneapolis 13. Written by G. L. Oscarson, the company's chief application engineer, it deals with proper rotor flywheel effect (WK^2) as a preventive measure for voltage fluctuations when driving reciprocating compressors with direct-connected synchronous motors.

Electric Unit Heaters

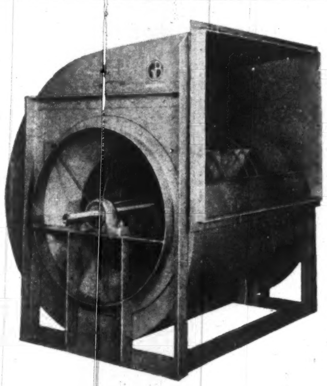
HPAC 111—Catalog EC-62 describes all-electric unit heaters for heating isolated areas, buildings, offices, or other spaces where intermittent heat is needed — Electromode Corp., 45 Crouch St., Rochester 3, N.Y. It illustrates the "Safety-Grid" heating element and covers combination portable and suspension type unit heaters, ceiling or wall suspension types, and control equipment. Mounting and wiring diagrams are given for heaters requiring external controls.

Electronic Control System for Process Variables

HPAC 112—Data Release A-703 explains the "Autronic" control system which utilizes electronics for automatically measuring and controlling process variables such as temperature, pressure, level and flow — The Swartwout Co., 18511 Euclid Ave., Cleveland 12. A typical application is discussed.

Electronic Temperature Control

HPAC 113—Specification sheet 114 describes the "Pyr-O-Vane" controller, with snap action, which is available with one, two or three position electronic control — Minneapolis-Honeywell Regulator Co., Brown Instruments



GENERAL—Type BB

GENERAL CENTRIFUGAL FANS, Type BB having a backward wheel are designed for operating at higher speeds, for the delivery of large air volumes with a minimum of noise and vibration. This non-overloading type wheel construction is well suited for direct connecting to motors at standard speeds. The General Type BB is used where varying flow resistance is encountered.

Heating, Ventilating, Air Conditioning, Industrial Oven Recirculating, Forced and Induced Draft, Dehydrating and Drying Systems use the General Type BB.

Bulletin BB-101 upon request.

27 Years Serving the Nation's Industries in all Uses Involving the Movement of Air.

Sales and Engineering Offices in all Principal Cities.

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GENERAL BLOWER CO. **8608 Ferris Ave., Morton Grove 12, Illinois**

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AUTO-RAD GIVES YOU *BOTH*

- **EASY INSTALLATION FOR YOU**
- **LASTING CUSTOMER SATISFACTION**

There may be cheaper types of baseboard radiation than AUTORAD but in no other finned type radiators can you get finer engineering design, better materials and fabrication, and as beautiful appearance.

All-steel construction makes bond between fins and pipe **permanent.** No electrolytic action or expansion differences can loosen the fins and reduce heat transfer. Fin spacing is ample for easy cleaning.

On your next job of new construction or remodeling, try AUTORAD. It will build business for you by the satisfaction it gives.

Ask for Form AR-101 and Bulletin 50

AUTORAD Finned Pipe

Space Saving
Easily Installed
Efficient and Economical

AUTO-RAD Inc.

Manufacturers of Heat Transfer Equipment Since 1920

3535 W. Fillmore St., Chicago 24, Ill.

Photograph courtesy the Milwaukee Sentinel

when—

WISCONSIN COLD STORAGE COMPANY

freezes moose browse—

they use VILTER of course

● The Canadian Moose, it seems, becomes a fussy eater when he's put behind bars. Recently the Milwaukee Zoo imported a pair of young moose from the Kenora district in Ontario, and feeding them became an immediate problem. The problem wasn't beyond the Zoo Director, however. He put the Zoo people to work hand-picking oak, willow, maple, dogwood, and honeysuckle leaves, and packing them carefully in boxes.

Next, he sent the boxed browse to Wisconsin Cold Storage Company for fast freezing and zero storage. Now the fussy young moose are thriving on leaves that are as good as fresh—thanks to an alert Director, to Wisconsin Cold Storage, and to the Vilter Refrigeration installed there.

It's no great trick, of course, for Vilter refrigeration to help store frozen leaves for moose. But Vilter refrigeration daily plays a part in unusual and difficult refrigeration installations. No matter how unusual your application, or how rigid your specifications, versatile Vilter refrigeration can be developed to fill the bill. And do it, more than likely, at considerable savings in costs, both now and through the years.

Your nearby Vilter Distributor or Representative will be glad to show you how Vilter equipment and Vilter engineering can help you save money.

Vilter

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY
MILWAUKEE 7, WISCONSIN

Ammonia and Freon Compressors • Pakicers • Evaporative and Shell & Tube Condensers • Pipe Coils • Valves and Fittings • Air Conditioning

Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. Both the measuring and control mechanisms are plug-in units.

Estimating and Installing Baseboard Heating

HPAC 114—Folder designed as a guide for estimating and installing baseboard heating — Radiant-Ray Radiation, Inc., 900 W. Main St., New Britain. Conn. It offers general information on baseboard radiation, describes the company's product (giving a net price list of all components), includes a heat loss calculator, an installation guide, and various forms which the dealer may use.

Flow Meters

HPAC 115—Bulletin F1605 covers Series 500 flow meters for recording, integrating, indicating, automatically controlling and telemetering flow of steam, water, air, gas, oil. solutions and other fluids — The Bristol Co., P.O. Box 1790, Waterbury 20, Conn.

Gas Cutting Machine

HPAC 116—Form ADC 673 describes the No. 20 "Radiagraph," designed specifically for use as a travelling carriage for mounting such equipment as the "Airco-matic^{R}" machine and the "Heliweld" machine holder, and for general use as a portable, motor driven, straight track guided cutting machine — Air Reduction Sales Co., 60 E. 42nd St., New York 17. Applications are illustrated.

Grilles, Registers and Frames

HPAC 117—Pocket catalog shows a line of registers, grilles and frames, and includes complete technical information on them — Standard Stamping and Perforating Co., 3151 W. 49th Place, Chicago.

Heat Exchangers

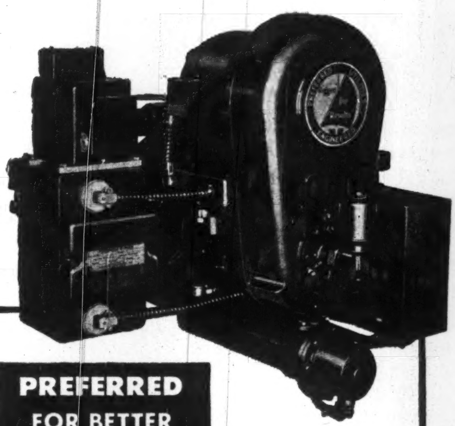
HPAC 118—Catalog describes heat exchangers in terms of their use for heating and cooling, condensing, and evaporating — Superior Combustion Industries Inc., Times Tower, Times Square, New York 18. It outlines the basic components — heads, shells, and tube bundles — and also gives special attention to tank heaters and fuel oil heaters.

High Pressure Air Distribution Products

HPAC 119—Bulletin F 4960 offers information on high pressure air distribution, and on velocity and pressure reduction devices which can be used with standard grilles and conventional ceiling outlets in high pressure installations — Barber-Colman Co., 1228 Rock St., Rockford, Ill. Included is a discussion of noise levels and pressure drop. The devices are available in two basic forms: first, an assembly consisting of a velocity to static converter, a pressure reducing valve, and a "Deflectrol" housed in a sound trap; second, a pressure reducing valve only.

Indicator-Alarms

HPAC 120—Bulletin 7411 covers "Autocon Multalarms," for use where emergency conditions of liquid level, pressure, temperature, smoke, gas, etc., might develop — Automatic Control Co., 1005 University Ave., St. Paul 4. Units have an automatic reset which provides continuous visual indication until the emergency condition is corrected, and they may be arranged with any number of stations and alarms.



PREFERRED
FOR BETTER
PERFORMANCE

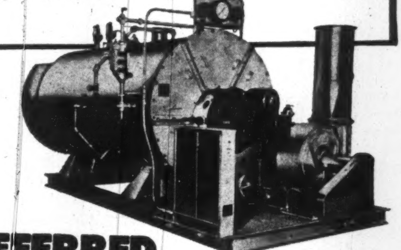
LOWEST INSTALLATION COST

That's right! To install a Preferred Horizontal Rotary Oil Burner costs less than any other industrial oil burner. Exclusive and patented features cut time and labor needed for wiring, brickwork and piping. For example, all basic burner components are completely wired to the terminal junction box. Preferred has been able to lower installation costs because of their years of experience as a dealer, installer and distributor of oil burners. And they have put this practical experience to work for you.

Originally designed to meet the exacting requirements of the Preferred Unit Steam Generator, its fully automatic operation with residual fuels proved so successful that it has won wide acceptance for conversion applications.

It is available with associated Preferred products such as enclosed, pre-wired, union approved panels as well as pump and heater sets where applicable.

At Preferred you get all major job requirements from a single source.



PREFERRED
Unit Steam Generator

The Preferred Unit Steam Generator is a custom-built boiler designed to maintain its guaranteed efficiency for a quarter of a century with a minimum of maintenance. It is the result of 28 years of combustion experience combined with the latest technical advances in pressure vessel design. That is why the Preferred unit offers the lowest installation cost, greatest economy and longest life of any steam generator.

Write for Burner Bulletin 175, Generator Bulletin 1000 and material cost estimates on your application. PR-201

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MANUFACTURING CORPORATION
1860 BROADWAY, NEW YORK 23, N. Y.

Speed-Trols Solve Many Problems of Ventilation Design

Speed-Trol Variable Speed Drives solve many heating, ventilating and air conditioning problems and permit design of flexible systems . . . states Robert A. Lowe of Storms & Lowe, Consulting Engineers, Los Angeles . . . Speed Trols allow volume of air to be varied to meet any requirements—more air for summer ventilation, less for winter . . . systems may be designed with capacity for future additions . . . future installation of refrigerated cooling coils may be made without loss of air quantity . . . Speed-Trols provide quiet operation.

STERLING KLOSD MOTORS

OUTSTANDING FEATURES FOR BETTER AIR CONDITIONING:

. . . quiet operation—protected construction—streamlined design—cool running—direct through ventilation—prelubricated, double shielded ball bearings—NEMA dimensions—crossline starting—liberal connection space—dual voltage—vinyl acetal insulated wire in stator windings—molecular welded connections. Available with feet or footless, face or flange mounted, drip-proof or splash-proof.

WRITE FOR BULLETIN NO. FQ-112

STERLING ELECTRIC MOTORS

Plants: New York City 51; Van Wert, Ohio; Los Angeles 22;
Hamilton, Canada; Santiago, Chile
Offices and distributors in all principal cities

Industrial Instruments

HPAC 121—*Tomorrow is Today*, a 20 page illustrated booklet, outlines the role of industrial instruments and controls in accelerating research and production — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne & Windrim Aves., Philadelphia 44.

Industrial Mechanical Freezers

HPAC 122—Folder illustrates and describes industrial mechanical freezers designed to produce and hold temperatures as low as −165 F — Industrial Div., Webber Appliance Co., Inc., 2740 Madison Ave., Indianapolis 3. Over 45 standard models are listed, ranging in cold chamber capacity from 4 to 45 cu ft.

Instantaneous Water Heaters

HPAC 123—Catalog No. HE 1 gives dimensions, capacity ratings and installation data on standard type IU instantaneous heaters — Yula Water Heaters, Inc., 166 W. 225th St., New York 63.

Insulations, Refractories, and Other Products

HPAC 121—Catalog IN-57A describes insulations, refractories, packings and gaskets, and asbestos-cement pipe — Johns-Manville, 22 E. 40th St., New York 16. Applications are illustrated, and physical properties and other descriptive data are given for each product. Size and packaging information is tabulated.

Leather Belting

HPAC 125—Booklet (Form A-200) covers "Monobelt" for regular utility drives, and its variations (with tension base, etc.) for special applications — Alexander Brothers, 406 N. Third St., Philadelphia 23. Also covered are a belting for use on taper cone pulleys and other special products. Installation and maintenance are discussed.

Leather Packing

HPAC 126—Form A-49 describes leather packings used in hydraulic and pneumatic machinery — Alexander Brothers, 406 N. Third St., Philadelphia 23. Covered are the four standard types — cups, U's, vees and flanges.

Lubricated Plug Valves

HPAC 127—Catalog covers a complete line of lubricated plug valves, in sizes from ½ to 12 in., for use where leakproof operation as well as corrosion resistance is required — Porter Valve Div., H. K. Porter Co., Inc., 1150 N. Peoria St., Tulsa 1. Information on working pressures, materials, design, manufacturing methods, accessories, lubricants, and pressure and temperature ratings is included.

Manual on Packaged Steam Generators

HPAC 128—Architects' and engineers' manual covers "Steam-Pak" generators, giving data needed for laying out and writing specifications for boiler installations involving high pressure steam, low pressure steam, or hot water — York-Shipley, Inc., York 4, Pa. Drawings show hookups for various types of process steam and heating applications. Piping, connection sizes, and electrical wiring also are diagrammed. Requests (on letterhead) for the manual should be sent to the company.

Darling it's so exciting . . .

I just can't wait

to see those sensational, new

STANDFORATED

Perimeter Baseboard Registers

WITH SLIDING DAMPER CONTROL

Write Now for Your Free Copy of Standard's Amazing New Pocket Catalog

- Used in homes, schools, churches and commercial installations.
- Comes in four foot sections.
- Simplifies balancing of heating systems.
- Fabricated of 20 gauge steel.
- Finished with Prime Coat only—special finishes on request.

Standard Stamping & Perforating Co.

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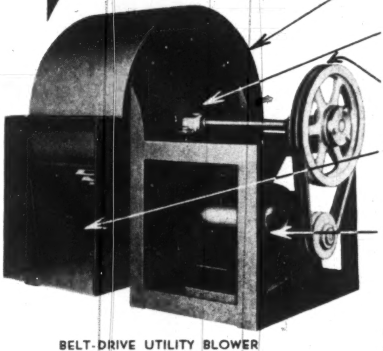
Attach this to your business letterhead and mail for new catalog.

Check THESE SPECIAL FEATURES
see why Peerless offers you
"THE SMOOTHEST PERFORMERS ON THE MARKET"



BELT-DRIVE UTILITY BLOWER

ARC WELDED FRAMES AND HOUSINGS
There's nothing to shake loose in a Peerless Blower! Frames and housings are constructed of heavy gauge metal, arc welded and finished in enduring green baked enamel.

DYNAMICALLY BALANCED BLOWER
Noiseless operation is the result of Peerless special aerodynamically balanced blowers . . . smooth-running after years of continuous service.

DUAL-GRIP ADJUSTABLE BELTS
Peerless Drive Belts are specially designed to equalize the load and provide the maximum ranges in speed.

CONVERTIBLE DISCHARGE
Standard horizontal bottom discharge, clockwise rotation. However, Peerless units can be supplied with counterclockwise action and, during installation, housings will convert to any angle of discharge.

CUSTOM BUILT PEERLESS MOTORS
Every Peerless Fan and Blower is equipped with a Peerless-made motor designed with current characteristics suitable for your requirements. This makes for perfect co-ordination between Peerless-made drive and Peerless-made Fans and Blowers.

Guaranteed Performance Since 1893

For 59 years, the Peerless Electric Company has been specializing in the production of high quality, efficient air moving equipment. Specify Peerless and you get the best.

A COMPLETE LINE FOR EVERY REQUIREMENT

- DIRECT DRIVE EXHAUST FANS
- UTILITY BLOWERS
- AUTOMATIC LOUVERS
- BELT DRIVE BLOWERS
- PRESSURE BLOWERS

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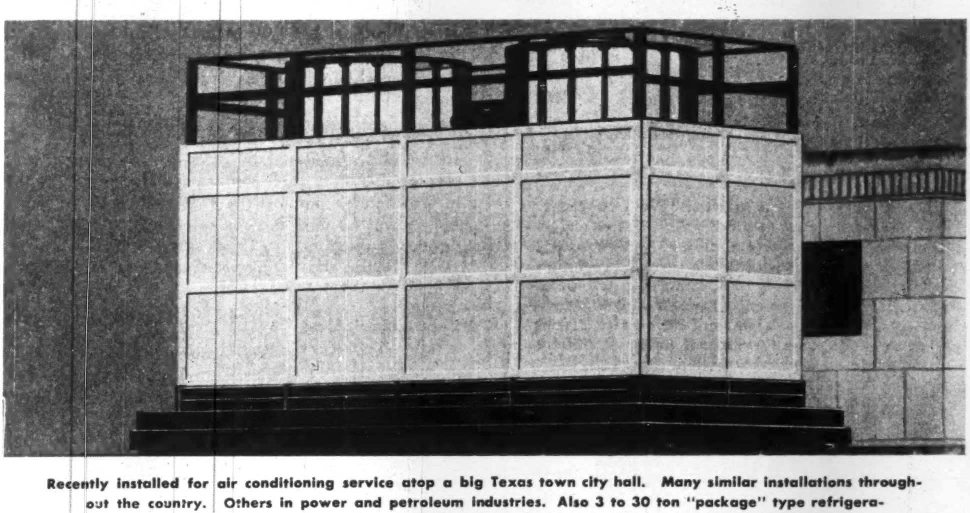
1409 WEST MARKET ST. · WARREN, OHIO
FAN AND BLOWER DIVISION

Peerless Electric

ANOTHER BETTER BUILT UNITED COOLING TOWER



Recently installed for air conditioning service atop a big Texas town city hall. Many similar installations throughout the country. Others in power and petroleum industries. Also 3 to 30 ton "package" type refrigeration units. Write for Bulletin No. 50. Get United plans and prices before you buy.

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Method for Testing Air Filter Efficiencies

HPAC 129—*Technical Report on Improved Testing Methods for Air Filters* (16 pages) describes the "Far-Air" method, by which air filters are tested according to dust particle size — Farr Co., P.O. Box 10187, Airport Station, Los Angeles 45. The new method is designed to avoid discrepancies between calculated, and actual, performance — caused by the fact that filters, regardless of design, operate at different efficiencies as the size of the dust particle varies. From the efficiency tables obtained with the new tests, the performance of filters can be predetermined for specific operating conditions. This may save the filter user the expense of installing equipment more sensitive than what is required, the company states. The testing equipment is illustrated, and test results are shown.

Motors

HPAC 130—Form 943 is a condensed price list for motors, including such types as squirrel cage induction, wound rotor induction, direct current, gear, single phase, etc. — Century Electric Co., 1806 Pine St., St. Louis 3.

Nickel Alloy Steel Castings

HPAC 131—32 page bulletin discusses industrial uses of nickel alloy steel castings — International Nickel Co., Inc., Dept. EZ, 67 Wall St., New York 5. Data on properties and applications of cast nickel steels of the constructional grades is classified by industrial fields. Low temperature properties, abrasion resistance, depth hardening and welding are discussed; and recommended specifications and compositions are given for typical service applications.

Non-Indicating Pressure Controller

HPAC 132—Bulletin 16-1 covers the "Pressure Pilot" non-indicating pressure controller, giving specifications, mounting dimensions, operation data, and other information — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Oil Mist Precipitator

HPAC 133—Catalog E-50 discusses the purpose, principles of operation and construction features of an oil mist precipitator designed to eliminate from the atmosphere coolant oil mist and smoke emanating from various industrial operations — Trion, Inc., 1000 Island Ave., McKees Rocks, Pa. Suggested methods of mounting are diagrammed.

Oxygen Indicator

HPAC 134—Bulletin DW-4 covers the type C-2 oxygen indicator for use in industrial atmospheres, in measuring the oxygen content of fuel gases, measuring combustion efficiency, etc. — Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8. It gives details on operation, design features and maintenance. (In the improved model, three points require maintenance attention — the carbon electrode, the detector cell, and a dry cell).

Package Steam Generators

HPAC 135—Catalog PG-51-2 gives dimensions, specifications, etc., of Series AG package steam generators (with or without superheat) in a wide range of capacities, at

Save space and cut installation costs

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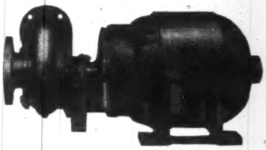

"Close-Cupld" Centrifugal Pumps

If you're looking for dependable, 24-hour-a-day pumping efficiency, yet are limited in space—you will find the Goulds Fig. 3650 "Close-Cupld" centrifugal pump ideal. This versatile, adaptable pump is a self-contained unit. It needs no space-consuming special foundations. There's no necessity for an unwieldly base plate to support pump and motor. This compact design also assures quick, easy installation—cutting costly labor time.

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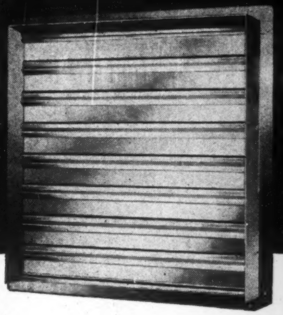

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IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

WRITE FOR NEW AIR-FLO CATALOG 44-D

Illustrations and details of the complete Air-Flo line.

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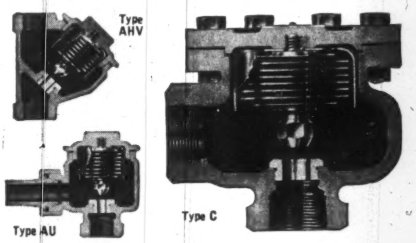

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FANS

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Backward curve blade type with non-overloading characteristics. Housings constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

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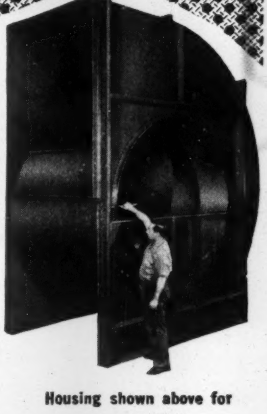
Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia.



Housing shown above for 86½" wheel

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that means
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*Made from malleable iron with tensile strength of 55,000 lbs. per sq. in.—they won't fail.

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MANUFACTURING CO.
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design pressures of 250, 525 and 825 psi — Foster Wheeler Corp., 165 Broadway, New York 6. Basic construction and control and instrumentation are covered.

Packing

HPAC 136—Booklet covers asbestos packing for stuffing boxes, stainless steel packing for use on rods and valve stems, packing for petroleum products, air pump packing, etc. — The Allpax Co., Inc., Mamaroneck, N. Y. Also covered is a tool for cutting gaskets of from ½ to 48 in. in diameter, from compressed asbestos sheet, rubber, felt, and similar materials.

Pipe Covering

HPAC 137—Bulletin G-11 describes, illustrates, and lists specifications for "Aircell", wool felt, foil anti-sweat, and anti-sweat pipe covering; foil insulation; and corrugated asbestos paper — Lynch Asbestos Co., 2939 So. Sunol Drive, Los Angeles 23.

Pneumatic Ejectors

HPAC 138—Catalog 4000-C describes all types of "Shone" pneumatic ejectors, giving information on both mechanically and electrically controlled ejectors for pumping, sewage, drainage and solids-carrying liquids — Yeomans Brothers Co., 1433 N. Dayton St., Chicago 22.

Relays

HPAC 139—Catalog describes the complete line of "Amrecon" relays, including the ten basic models (both a-c and d-c types) and their variations, and discusses a number of specialized controls such as snap action and latching relays, screw terminal relays, etc. — American Relay & Controls, Inc., 4939 W. Flournoy St., Chicago. Selection data is given.

Rubber Lined Pipe Joint

HPAC 140—Booklet describes the "Gaco" system for joining rubber lined pipe — Gates Engineering Co., P.O. Box 1711, Wilmington, Del. The company's rubber gasket fits into the counterbored pipe lining. The split flange is then bolted together with a hand wrench to complete the assembly. The booklet presents basic principles of the system, design features, and methods of installation, and illustrates parts and tools needed.

Spray Nozzles and Accessories

HPAC 141—Catalog No. 31 treats spray nozzles and accessories for use in industrial and air conditioning applications — Industrial Div., Delavan Mfg. Co., 3009 Sixth Ave., Des Moines. It also introduces a new line of swivel adapters, and gives selection data.

Stainless Steel Valves and Fittings

HPAC 142—First issue of new periodical, *Valve Topics*, is available for those who design, specify, or use stainless steel valves and fittings — The Cooper Alloy Foundry Co., Bloy St. and Ramsey Ave., Hillside 5, N.J. Issues will contain application stories, showing industrial uses of the company's valves; a column devoted to specific valve problems; and other special features such as a review of available current literature.

Standardized Fittings for Warm Air Heating and Air Conditioning

HPAC 143—Reference manual (16 pages) illustrates and names 104 standardized fittings commonly used in

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Adjustable Pitch Blades for ANY Requirement

Another "Chicago" Exclusive—Adjustable aluminum alloy blades can be pitched for any ventilation requirement . . . any motor H.P. Special suspension mountings and vibration control pads plus a highly efficient "mushroom" type design make this the quietest roof exhauster on the market.
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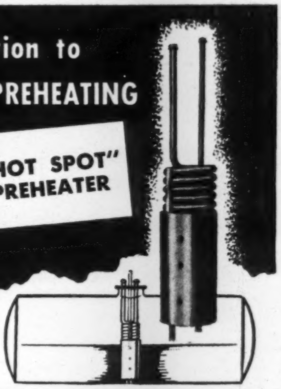

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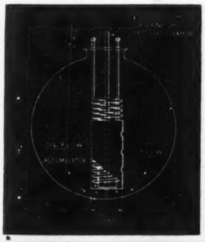

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Special design "flow accumulator" causes liquids to pass over heated coils. Does the job efficiently and at low cost.

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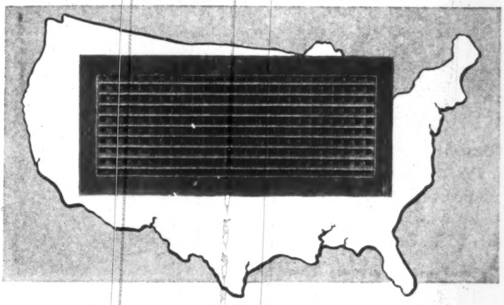

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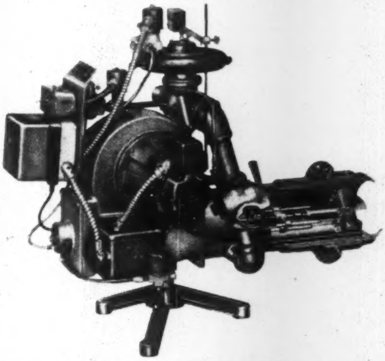

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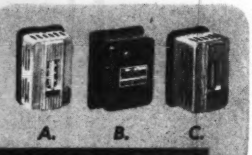

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STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

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Heating, air conditioning and plumbing contractors and engineers receive expert service from Auer on perforated metal grilles. The Auer line includes a variety of attractive designs for all purposes — air conditioning, ventilating, radiator enclosure, or concealment. We furnish almost any size, to your order, and in all available materials. Order Auer grilles by name and number. Send for bulletin showing all designs.

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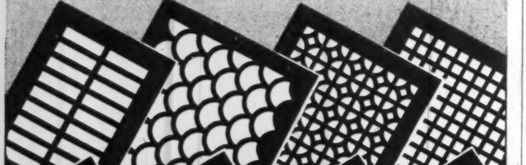

warm air heating and air conditioning installations—Air Distribution Institute, 2130 Keith Bldg., Cleveland 15. The list is in accordance with U.S. Dept. of Commerce Simplified Practice Recommendation R-207-49, and manufacturers' numbers are given on each item (for the institute's member companies).

Steam Turbines

HPAC 144—Catalog ST102 covers a line of steam turbines available in a range of from 5 to 1200 hp, single stage types, with variable speeds — Whiton Machine Co., 190 Howard, New London 14, Conn. It illustrates and describes the solid steel rotor, the nozzle block and reversing chamber unit, the speed governor and governor throttling valve, the shaft packings, etc., and special governing devices.

Steel Tubing for Radiant Heating

HPAC 145—Bulletin describes specially processed, flexible, single wall, welded steel tubing specifically designed for radiant heating — Rochester Products Div., General Motors Corp., Rochester, N.Y. Special features are outlined (conductivity and expansion, etc.), and methods for bending and other relevant matters are discussed.

Storage and Handling of Heavy Fuel Oils

HPAC 146—Bulletin 1644 discusses the general problems of heavy fuel oil storage and handling, and describes electric oil line heaters, suction stub heaters, suction bells, two and six pass fuel oil heaters, and tank outlet oil heaters — Preferred Utilities Mfg. Corp., 1860 Broadway, New York 23.

Technical Data Catalog

HPAC 147—1952 catalog of pocketsized "Dollar Technical Data Books" cover such subjects as piping data, a-c motors and generators, heating, and air conditioning — Lefax Publishers, Philadelphia 7. Over 2000 subjects are listed. Each loose leaf book contains about 140 pages of reference material.

Temperature Controls

HPAC 148—Catalog 400 describes "Thermoswitch" temperature controls, covering design, operating characteristics and installation of each of the 10 variations on the basic device — Fenwal Inc., Ashland, Mass.

Time-Temperature Control

HPAC 149—Catalog 6020 describes "Cam Programmer" thermometers for processes which must be carried out with a rigidly fixed relationship between temperature and time — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. The instrument combines as many as six functions from a standard sized instrument case.

Totally Enclosed, Fan Cooled Motors

HPAC 150—Bulletin 51B7149B gives construction features and details of totally enclosed, fan cooled motors with tube-type, air-to-air heat exchangers in ratings of 40 hp at 600 rpm through 800 hp at 3600 rpm — Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee. Standard and explosionproof models are covered.

Tubing Failures

HPAC 151—Booklet TR 516 discusses factors affecting tube life in high pressure, high temperature applications —

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EXHAUSTERS

REVOLUTIONARY WALL UNIT
Aluminum rust proof construction assures better ventilation longer.

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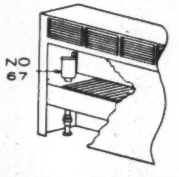

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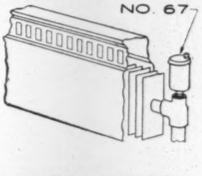

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G&O COILS for HEATING and COOLING

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THE LEAK-PROOF SEALER FOR GASKET AND PIPE JOINT CONNECTIONS!

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Please forward free sample of Key-Tite Waterproof Sealing Compound.
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The Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa. It presents the results of a number of investigations of failures of carbon steel, intermediate chromium-molybdenum alloy steel and stainless steel tubing in boilers, cracking stills, heaters and heat exchangers, and discusses the development of high temperature tubing.

Use of Adhesives in Construction

HPAC 152—Two bulletins in the *Construction by Adhesion* series discuss construction applications of adhesives and surface anchors — Miracle Adhesives Corp., 214 E. 53rd St., New York 22. Bulletin 1 lists the general characteristics of the company's adhesives (designed to bond to almost any surface, form a vapor seal, deaden vibration, act as an anti-corrosive coating, etc.), and includes a bonding chart, and a table covering many specific applications. Bulletin 2 gives specifications for installing insulation on the exterior of metal ducts using the company's surface anchors and adhesive.

Valve Lubrication

HPAC 153—Article reprint, *Proper Valve Lubrication—A Prerequisite to Good Control*, covers the functions, methods of application, and proper selection of lubricants in general use — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Vertical Steam Turbines

HPAC 154—Folder covers steam turbines for vertical drive in three general sizes, the largest designed to handle

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INSULATE
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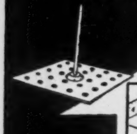

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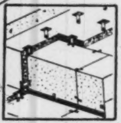

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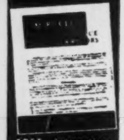

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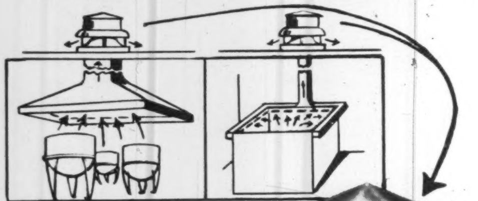
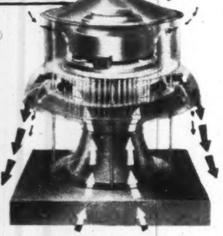

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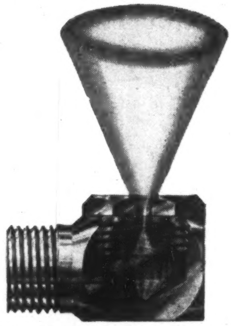

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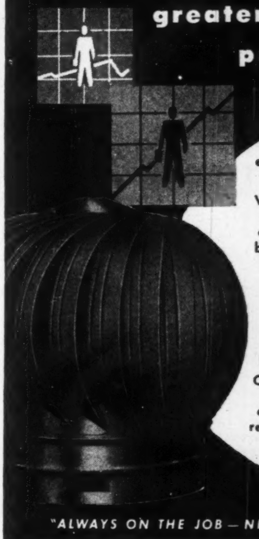

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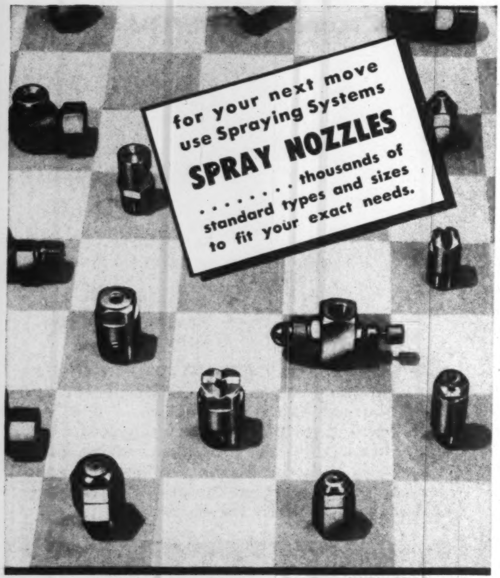

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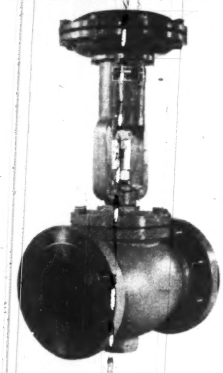

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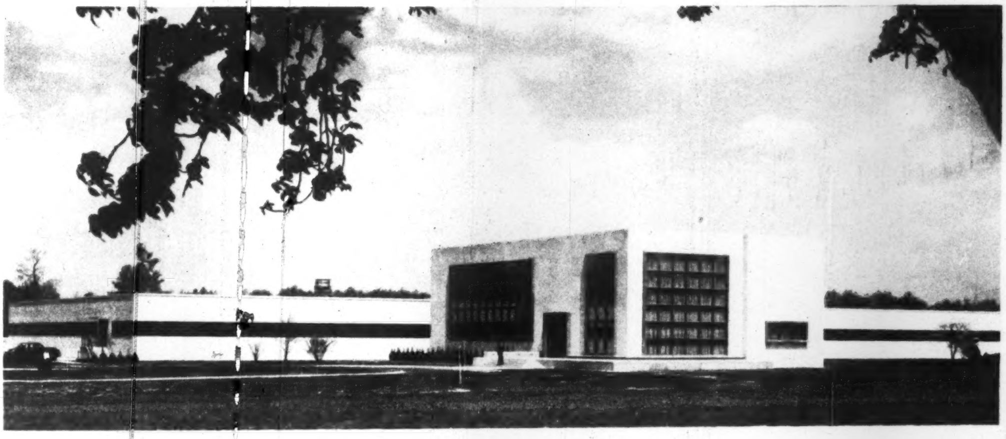

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See CATALOG S-52

Clarage Multitherm conditioning units and fans are covered in Sweet's 1952 Architectural File and in the January 1952 Directory issue of Heating, Piping and Air Conditioning—or write us.

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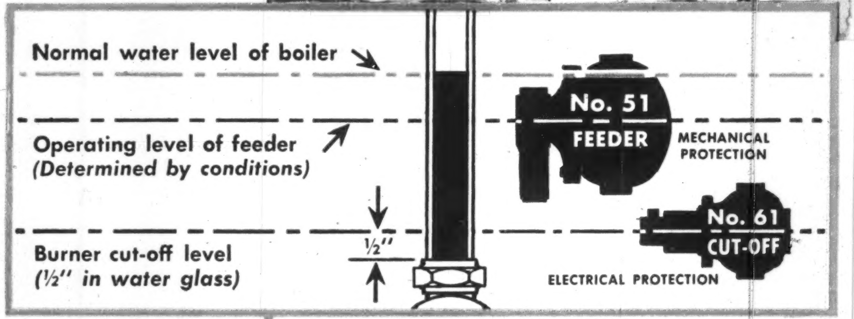
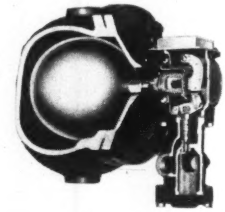
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

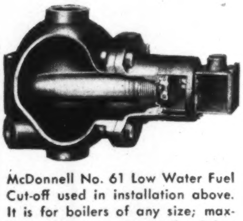
What IS the best way to maintain the water level of those process boilers?



The diagram shows the location of No. 51 Feeder and No. 61 Cut-off on the boiler illustrated, but can be applied to all cases. Since some water is returned to the boiler, the feeder is located to function below the normal water level. In all cases the cut-off switch is located to function when the water level drops to ½" in the gauge glass.



McDonnell No. 51 Boiler Water Feeder used in installation above. It is for boilers above 5000 sq. ft. capacity; maximum steam pressure, 35 lbs. Other types for boilers of all sizes; pressures up to 75 lbs.



McDonnell No. 61 Low Water Fuel Cut-off used in installation above. It is for boilers of any size; maximum steam pressure, 20 lbs. Other types for higher pressures.

Here is a simple answer to what some heating men consider a difficult problem. It's a simple and dependable way to maintain the water level in a boiler where all or most of the steam is used in process. Certainly, such boilers need the most adequate water level control that can be provided.

First notice the installation above. This boiler has *two* McDonnell controls. One is a No. 51 Boiler Water *Feeder;* the other, a No. 61 Low Water Fuel *Cut-off*. Why both a feeder and a cut-off? Why not a McDonnell feeder and cut-off combined?

The answer is that in process boilers—particularly the larger ones—we want to provide a greater differential between the opening of the feeder and stopping of the firing means than is possible when a feeder-cut-off combination is used.

The diagram explains this. We know that in a process boiler we need real water feeding capacity, so we position the feeder to start opening as soon as the water level falls a short distance below the normal level of the boiler. When the water level has fallen two inches below the operating level of the feeder the feed-valve will be wide open, delivering its maximum capacity to the boiler.

Now the feeder so located will maintain the water level under all normal conditions, so we want to give it "full charge" of the boiler and use the low water fuel cut-off only as a safeguard against an emergency condition. Therefore we set the fuel cut-off as low as safety permits—clear down where it will not stop the burner until the water falls to ½ inch in the water glass. In this installation the burner cut-off point is far enough below the opening point of the feeder, providing plenty of latitude for the feeder to do its job properly.

If a feeder-cut-off combination were used, the low water cut-off switch would stop the burner *before* the feeder had reached its maximum capacity. By using two controls—a feeder and a separate low water cut-off—this unnecessary and annoying interruption of operation is completely avoided.*

The controls used on this boiler are illustrated, but the same principle of wide operating differential can be provided for process boilers of varied sizes and pressures by combinations of other McDonnell feeders and cut-offs. Our engineering department will be glad to give recommendations covering specific conditions.

* This method should also be considered for all larger boilers where at times the condensate is diverted for blow-down, skimming the boiler, or where steam is used at times for process work. The added cost of using the two controls is insignificant in terms of larger boilers.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Avenue, Chicago 18, Illinois

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